THE
ELECTRICAL REVIEW.

VOL. LXVIII. MAY 5, 1911. No. 1,745.

ELECTRICAL REVIEW.

Vol. LXVIII.] CONTENTS: May 5, 1911. [No. 1,745.

	Page
Imperial Telegraphs	701
The Status of Engineers	702
Battery Economics	702
Copper: Production and Price in 1910 and the Present Outlook (*illus.*)	703
Free Wiring	704
High-Voltage Railway Motors for Direct-Current Working (*illus.*)	706
Correspondence:—	
New Steamship Line to Siberia	709
Daylight "Saving"	709
Steel Chimneys	709
Electricity Meters	709
No Red Tape	709
Re Copyright and Patents	709
Cord Grips	709
Electrical Trades Benevolent Association	710
The "Thomas" Transmission for Petrol Vehicles (*illus.*)	711
Legal	712
New Electrical Devices, Fittings and Plant (*illus.*)	715
Business Notes	715
Notes	722
City Notes	724
Electric Tramway and Railway Traffic Returns	728
Stocks and Shares	728
Share List of Electrical Companies	729
Metal Market.—Fluctuations in April	731
Foreign Compared with Home Industrial Finance (*concluded*)	731
Proceedings of Institutions:—	
Imperial Telegraphs	735
Battery Economics and Battery Discharge Arrangements (*illus.*)	735
Foreign and Colonial Tariffs on Electrical Goods	739
New Patents Applied For, 1911	740
Abstracts of Published Specifications	740
Book Notices	740

Contractors' Column ... Advertisement pages xxiv, xxvi and xxviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGHEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 18s. 6d.; Canada, £1 1s. 3d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

IMPERIAL TELEGRAPHS.

THE theme of Imperialism naturally conveys the idea of unity with expansion, and incidentally it embodies the conception of increased facilities for linking-up the multiplicity of forces that constitute the elements of progress within the Empire. There is little need to preach the doctrine of development of these means of improving the systems of communication within the Empire, for as a general principle it is accepted by representatives of every shade of political opinion. The precise form of the application of the principle depends upon the locality, the opportunities, and the man behind the scheme. Cecil Rhodes saw it in railways, and had the grit to achieve what he imagined good for the Empire. Men of the type of Sir Sandford Fleming, Sir Edward Sassoon, Sir Charles Tupper, and Mr. Henniker Heaton have long advocated a development of imperial telegraphs, and it is now a decade since the Committee of Lord Balfour of Burleigh on Coast Communications emphasised the advantages that would result from a British Grand Trunk cable scheme which should unite the Dominions beyond the Seas with the Mother Country. The Pacific cable, which was opened for traffic in December, 1902, was a practical result of this kind of advocacy; but we are still a long way from the realisation of the all-red route.

In a paper read last week at the Royal Colonial Institute by Mr. Charles Bright upon "Imperial Telegraphs," a good deal of the old ground of argument was again traversed, and the question of establishing an all-round imperial tariff was again put forward, although he was able to report but little progress in that direction. The idea appears to be to introduce uniformity in tariff as a set-off against the pooling arrangements of private companies. It is premature to express an opinion for or against such a proposal. Clearly, the task ahead of us is to make and lay the cables—State-owned or private-owned—within the imperial girdle, and afterwards to negotiate with respect to the system of charging for individual messages. It would have been helpful if Mr. Bright had put forward some figures to indicate the estimated capital for carrying out the work of completing the cables for the all-red scheme. In the absence of a substantial basis of that kind, the arguments are apt to drift into generalities, and the public fail to realise the practicability of establishing the required cables. In recent years the price of raw material has increased, but it is reasonable to suppose that the cables in question could still be made and laid at an aggregate cost not exceeding £10,000,000. For a great imperial purpose this sum is within the limits of what is attainable, and the conclusion seems inevitable that the real point at issue is something other than first cost. Experience is opposed to State ownership, where economical working of an enterprise is essential. For this reason it is unwise to regard the postal service as a fitting example from which to make deductions for a world-wide

cable undertaking. Any commercial firm of moderate business ability could make a handsome profit at delivering—on a monopoly basis—letters for a penny each, under present conditions of transit. To obtain a parallel, it is first necessary to ask whether it is possible, even if it were desirable, to have and to hold the monopoly of the telegraphs of the Empire that would be necessary to the establishment of an all-red route, upon which to impress an all-round imperial cable tariff.

Whatever may have been practicable a quarter of a century ago, the most appropriate policy for to-day appears to be judicious compromise, whereby private cable companies and the State may enter into reasonable agreements. Imperialism is a noble word, but nevertheless imperial monopoly is at least as costly to the public as a private monopoly. The cable system of the Empire demands control but not monopoly by the Empire. Mr. Bright very properly pointed out that the Government of this country has, in the past, exercised scarcely any control over the British cable system, and he reminded his audience of the well-known fact that in the matter of landing rights the Government has at all times possessed the means of control. In common fairness there is, of course, a great deal to be said upon the other side; for, inasmuch as the private companies were the pioneers, it is but just that they should reap the reward of their labour and intrepidity. There is obviously a point, therefore, beyond which "Imperialism" is but a synonym for Socialism of the most debased character.

Meanwhile, it is instructive to observe the progress of the German cable system, and to study the unity of purpose that exists between the private firms, the imperial interests, and the all-but-imperial banks. Possibly Germany has made a huge financial mistake in expending this lavish amount upon a cable system at a time of high prices. In any case, it affords an example of a system of imperial telegraphs worked out upon modern financial lines, and it will be worth while watching developments in the tariffs for purposes of comparison. Lastly, it has to be remembered that State ownership in this case can only be justified upon the hypothesis that every taxpayer within the State benefits from the enterprise in equal degree. For a postal system, the hypothesis perhaps holds fairly well; for inland telegraphs it is less tenable, and for an inter-colonial system of cables it is valid only to a limited extent.

The Status of Engineers.

In the current issue of the *Journal* of the Society of Arts, it is pointed out that accountants have long desired to place their profession in a position analagous to that of solicitor, doctor, and dentist, and a Bill has now been drafted and read a first time in the House of Lords which is approved by the representatives of the Chartered and Incorporated Accountants. Registers are to be kept of all persons practising as professional accountants at the date of the passing of the Act; no unregistered person is to be allowed to use the title of professional accountant, or practise as such. After the passing of the Act no one would be registered unless he was a member of one of the recognised associations or had passed certain prescribed examinations. Fines and penalties would be imposed on any unregistered person who called himself a professional accountant, and there would be power to expel members, and all the machinery of the law to support the registrars and the committees.

The Patent Agents have already secured legislative recognition of their status and rights; the engineers still stay out in the cold. Surely it should be possible for them also to combine and agree upon some similar scheme whereby their professional standing should be defined and safeguarded.

Battery Economics.

For some years past Mr. A. M. Taylor, of the Birmingham Corporation Electricity Department, has vigorously advocated the extended use of storage on scientific lines in electricity supply, and has supported his arguments with facts and figures, which must have been collected and analysed at the cost of a vast expenditure of time and labour. He is to be congratulated upon the measure of success which he has already attained in securing recognition of the value of storage when properly applied. Whether Mr. Pearce was influenced by Mr. Taylor's views or not, we cannot say, but at any rate he has installed a very large battery at Manchester with very gratifying results, and in the discussion on Mr. Taylor's paper before the Institution of Electrical Engineers last week, Mr. Pearce was able to say that the author's calculations regarding the results to be expected at Manchester had been fully borne out in practice—the only test that carries conviction where storage batteries are concerned. The Charing Cross Electricity Supply Co. and the Kensington and Metropolitan Companies also use storage to a considerable extent, and several other examples could be cited in this country, to say nothing of the far more general use of storage abroad.

We have always held and expressed the opinion that adequate storage was an important aid to the economy, as well as the reliability, of a supply of electricity, but we have laid stress upon the *adequacy* of the battery; while a small battery, no doubt, is of great assistance to a small station in the early days of an undertaking, it is worse than useless when by normal growth the output of the generating plant greatly exceeds that of the battery. The latter then becomes a minor factor in the business; either it is neglected and rots, or, if it is kept in order, it is at times called upon to shoulder burdens far beyond its powers, and is quickly reduced to scrap. This is not fair to the battery; it must be big enough to do its work without undue strain, and it must receive expert attention—otherwise storage is best left alone.

Another consideration is also of great importance in planning an installation; the battery should be situated as near as possible to the work it has to do. Only in this way can the full benefit of storage be realised. When thus applied it relieves the boilers, engines, dynamos, switchgear and feeders at the time of maximum load, enabling the full economy of capital expenditure to be effected, reducing the losses in the mains, and maintaining a more uniform pressure of supply. Further, it provides a safeguard against breakdowns in the feeders, as well as in the generating station, ensuring the maximum of reliability; and it affords a most valuable means of equalising the load on the generating plant and feeders throughout the 24 hours. The extent to which these benefits are secured depends upon the proportions adopted for the several parts of the plant; the danger is rather that, through timidity or incredulity, too small a battery will be installed than too large.

As for the loss in the battery, the fact is often overlooked that units generated at a high load factor cost far less than at a low load factor; if by equalising the load the cost of production is reduced only 50 per cent., the loss in the battery is amply covered—not forgetting that, in any event, only part of the output passes through the cells.

We print elsewhere in this issue an abstract of Mr. Taylor's paper and the discussion thereon; as we go to press we have received a supplementary communication from the author, the substance of which will be found in our "Notes" columns.

COPPER: PRODUCTION AND PRICE IN 1910 AND THE PRESENT OUTLOOK.

By JOHN B. C. KERSHAW, F.S.S.

The writer has for some years been studying the production and price curves of the copper mining industry, and has been accustomed to publish in April or May each year a summary of the results of this study of the past year's statistical information, and also a forecast of the future course of output and prices during the remainder of the current year. The large amount of copper used in the electrical engineering industries, and the marked variations in price which have occurred in the history of the metal during recent years, should render the subject of special interest and value to the readers of this journal. The figures used in the course of the article are those collected by the correspondents of the *Engineering and Mining Journal*, of New York, for the American and Mexican mines, and by Messrs. H. R. Merton and Co., of London, for the remaining copper mining

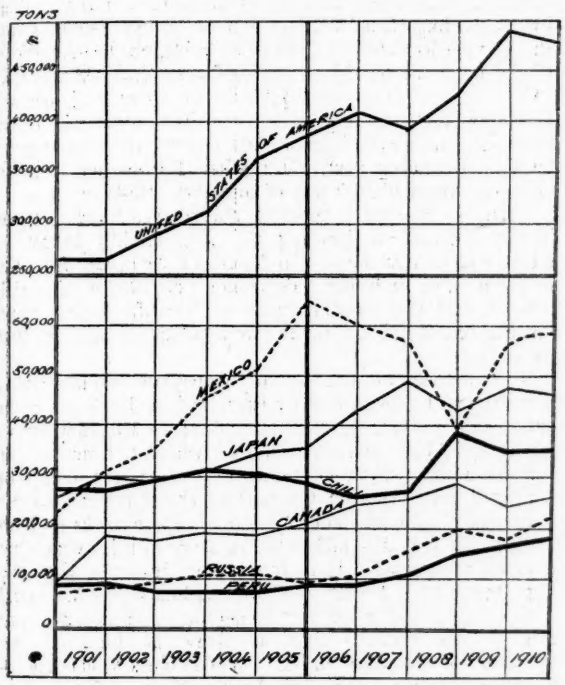


Fig. 1.

countries. The annual statistical circular published by the latter firm appeared on March 29th, 1911.

Production in 1910.

The aggregate output of raw copper by all countries of the world in 1910 amounted to 852,950 tons, an increase of 13,525 tons over that of 1909. This falling-off as compared with the gain of nearly 85,000 tons in 1909 was due to the attempt to curtail production and to reduce stocks on the part of those in control of some of the larger and more important mining companies. The effect of this curtailment of production upon stocks and prices will be dealt with in the second part of this article. Tables I and II give the more important figures for the output of copper during the past 10 years, and fig. 1 gives in graphic form the production curves for the more important mining countries.

TABLE I.—World's Aggregate Production of Raw Copper.

	Aggregate production in long tons of 2,240 lb.	Increase in tons.	Percentage increase.
1901	516,626	37,114	7·7
1902	541,295	24,669	4·7
1903	574,775	33,480	6·1
1904	644,000	69,225	12·0
1905	682,125	38,125	5·9
1906	714,100	31,975	4·6
1907	713,965	Dec. 135	—
1908	754,180	40,225	5·7
1909	839,425	85,245	11·2
1910	852,950	13,525	1·6

The percentage increase in 1910 was, therefore, the smallest of the past 10 years, with the exception of 1907, when an actual decrease in production of 135 tons was recorded. The aggregate increase in annual output, comparing 1900 with 1910, however, is 373,436 tons, equal to nearly 80 per cent.; and in 1911 or 1912 we may expect to see the production figures of 1900 doubled, and the copper output of all countries of the world approaching 1,000,000 tons per annum.

As regards the production figures for the leading countries, Table II gives the totals for the last two years, for all countries with an output of 5,000 tons and over.

TABLE II.—Copper Production in 1909 and 1910 of the Leading Producing Countries.

—	Production in long tons. 1909.	1910.	Increase in long tons.	Decrease in long tons.
Africa	14,945	15,205	60	—
Australasia ...	34,400	40,315	5,915	—
Canada	24,105	25,715	1,610	—
Chile	35,785	35,235	—	550
Germany	22,455	24,710	2,255	—
Japan	47,000	46,000	—	1,000
Mexico	56,325	58,825	2,500	—
Norway	9,280	10,425	1,145	—
Peru	16,000	18,305	2,305	—
Russia	17,750	22,310	4,560	—
Spain and Portugal	52,185	50,255	—	1,930
United States ...	490,280	484,890	—	5,390
Totals ...	820,510	832,190	20,360	8,870

The above 12 countries in 1910 yielded over 97 per cent. of the copper supplies of the world.

On examining the figures of Table II more closely, we find that four of the producing countries have decreases in output, namely, Chile, Japan, Spain and Portugal, and the United States; while eight countries have to record increases varying from 60 up to nearly 6,000 tons, Russia and Australasia heading the list of countries whose production is on the up-grade, with increases of 4,560 tons and 5,915 tons respectively.

In the light of the attempts made during 1910 to curtail production, the detailed figures for the mines and mining countries under the control of the U.S.A. financiers are of special interest, and are given in Table III.

TABLE III.—Copper Production in 1909 and 1910 of American-Controlled Mines.

Country.	Production in long tons. 1909.	1910.	Increase.	Decrease.
United States.				
Calumet and Hecla ...	40,000	35,000	—	5,000
Other Lake Mines ...	61,450	62,770	1,720	—
Montana	140,105	128,770	—	11,330
Arizona	130,375	132,625	2,250	—
Other States	118,350	125,725	7,375	—
Mexico.				
Boleo	12,230	12,795	565	—
Other Mexican ...	44,095	46,030	1,935	—
Chile	35,785	35,235	—	550
Peru	16,000	18,305	2,305	—
Japan	47,000	46,000	—	1,000

The decreased production of the United States is thus seen to be confined to the Calumet and Hecla, and Montana mines; whereas the other Lake mines, and the mines of Arizona and other States, all record small increases. Of the other countries included in Table III, Chile and Japan alone show a decreased production, which is more than balanced by the increased output of the mines in Mexico and Peru.

With these figures before one, it is evident that the curtailment of production which was expected in 1910, as the result of a merger policy on the part of the financiers interested in the U.S.A. copper mines, has not been very rigorously enforced outside the Montana area, and that unless there is a distinct improvement in the demand for copper during 1911, a much stricter check to production in the mining districts of the American Continent will be necessary, in order to bring about the rise in values so ardently desired by the speculators in copper.

Whether the conflicting financial interests involved in the control of the American copper mining industry will be able to arrange some common and united action in this matter of curtailment, is the question of the moment; and the writer will make some attempt to answer it, after discussing the variations in price that have occurred during the past 15 years.

II.—Price and Stock Variations in 1910.

The price variations of copper during 1910 have been almost entirely in a downward direction, and a fall of £5 17s. 6d. per ton occurred between December 31st, 1909, and December 31st, 1910.

The settlement prices of standard copper at the close of each month are given by Messrs. H. R. Merton & Co. in their valuable monthly circular for March as follows :—

TABLE IV.—Price Variations of Copper during 1910.

	£	s.	d.		£	s.	d.
December 31st, 1909	61	15	0	July 30th, 1910	55	10	0
January 30th, 1910	60	17	6	August 31st, 1910 ...	55	17	6
February 28th, 1910	59	12	6	September 30th, 1910	55	2	6
March 31st, 1910 ...	57	17	6	October 31st, 1910...	57	0	0
April 30th, 1910 ...	55	17	6	November 30th, 1910	57	5	0
May 31st, 1910	56	17	6	December 31st, 1910	55	17	6
June 30th, 1910	54	10	0				

Since the commencement of the present year, the depreciation in the value of standard copper has continued, and on March 31st last the settlement price was £54 10s. per ton.

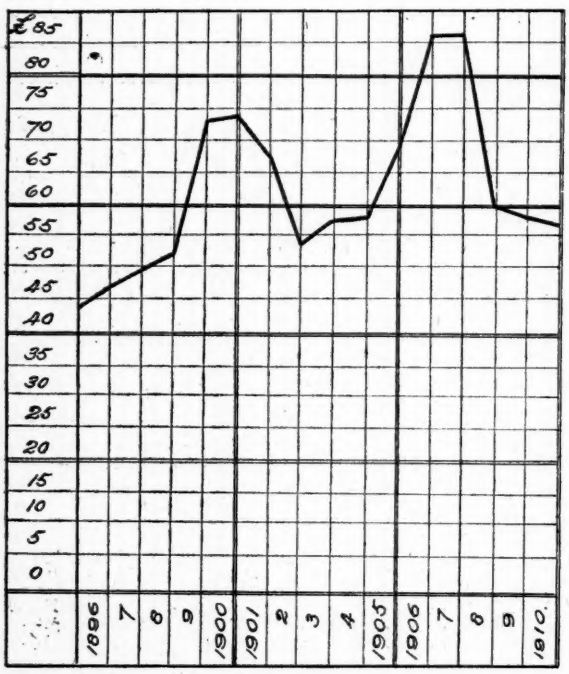


Fig. 2.

The average price of standard copper on the 1st of each month for the past three years has been £60 0s. 6d. in 1908, £58 17s. 3d. in 1909, and £57 3s. 2d. in 1910, so that the fall in values is rather over-accentuated by the comparison of the value on March 31st, 1911, with that of December 31st, 1909, when the price was at the highest point touched for the whole previous 12 months.

Fig. 2 shows the annual average price variations of copper for the period 1896-10 plotted as a curve, and from the study of this curve, supplemented by the figures given by Messrs. H. R. Merton & Co. for the stocks of copper held in England, France and America (or afloat thereto from Chile and Australia), some idea of the course of prices during the next 12 months may be gained.

The downward trend of the price curve has now lasted over three years, and one might reasonably have expected it to follow the example of the recovery of the year 1903, and to have commenced once again to ascend during 1910, if no outside influences had been at work to check or retard this recovery. One of these influences has been the large stocks of copper that had gradually accumulated in dealers' and manufacturers' warehouses during the year 1909. Messrs. H. R. Merton's figures for the combined visible supplies of copper in Europe (excluding Holland and Germany), and in America, as reported by the American Producers' Association during the past 15 months, are as follows :—

TABLE V.—Stock Variations in Europe and America During 1910.

Dec. 31st, 1909 ...	172,310	Aug. 31st, 1910 ...	172,899
Jan. 30th, 1910 ...	154,765	Sept. 30th	160,386
Feb. 28th	161,306	Oct. 31st	150,592
March 31st	166,711	Nov. 30th	144,460
April 30th	173,593	Dec. 31st	138,275
May 31st	178,434	Jan 31st, 1911 ...	146,783
June 30th	179,129	Feb. 28th	152,311
July 30th	175,418		

The cause of the failure of copper to rise above the present low level of values is thus seen to be due to this heavy incubus of stocks, which on February 28th, 1911, were only 9,000 tons less than on February 28th, 1910, and represent nearly 2½ months' supplies on the present basis of demand. The stocks held in Europe have, it is true, fallen by 27,000 tons (from 109,022 tons to 82,387 tons) during the 14 months covered by the above table, but the American stocks have increased by over 6,000 tons (from 63,288 tons to 69,924 tons) in the same period. It is practically certain that no marked recovery in price of the metal will occur until the stocks have been worked down to the more normal level of December 31st, 1908, when Europe and America each held about 55,000 tons of copper as visible supplies.

Trade in Europe is booming, and the demand for copper in the electrical engineering and ship-building industries must be at its maximum. In America the recovery from the financial and industrial depression of 1907-8 is still delayed, and this to some extent explains the slack demand for the red metal and the failure to reduce stocks in that country.

The revival of activity of American manufacturing industries is, however, now overdue, and is likely to occur either this year or next, if no unforeseen events occur to hinder it. This revival, combined with a continuance (in perhaps a more vigorous form) of the present policy of restricted production on the part of the American copper magnates, should lead to a depletion of copper stocks on both sides of the Atlantic, and to the recovery in price which has long been expected. It is improbable, however, that the high prices of the year 1907 will be touched by the metal during 1911, but a recovery to £60 or to perhaps £65 per ton, in the writer's view, is likely to occur, before the close of the year, unless a sudden check to the manufacturing prosperity of Europe should cause a marked slacking off in the demand for copper on this side of the Atlantic.

FREE WIRING.

[COMMUNICATED.]

Free or assisted wiring for electric light has ever been a thorny topic for municipal undertakings; those who have adopted it without careful consideration of all the factors which enter into the question have, in many cases, brought on themselves a great deal of trouble and expense, which could easily have been avoided had the proper policy been chosen and the system of work mapped out from the very beginning. The central-station engineer does not need to consider the matter long before he is convinced that free wiring will be of great assistance in extending the use of electricity and also in creating a demand for electrical installations. Very rarely will a consumer who has had a good installation be content to go back to gas, and while it may need some canvassing to get a shopkeeper to put in his first installation, there will be no need to follow him up when business considerations compel him to move into another shop where gas only is available, if a free wiring system is in operation in the town. A yearly tenant, or one on a short lease, will not spend money in fitting up electric wires in another man's property, but in very many cases that same tenant would be prepared to pay an annual rental to

get the conveniences and increased decorative facilities of electric light, if an installation were put in for him. It is such cases that the free wiring system is meant to meet; the wiring contractor has no spare capital to devote to this work, and landlords are proverbially difficult to move in such matters. This gives the electricity supply undertaking an opportunity of increasing its output without in any way competing with electrical contractors, and if the free wiring system has been arranged on sound business lines, there is very little risk to the undertaking, but some discretion must be used in accepting applications for free wiring. The experience of most undertakings which have tried free wiring shows that a good installation once connected is rarely disconnected because a new tenant coming in prefers to use gas; but a new tenant coming into a poor class shop in a mean neighbourhood would often prefer to use gas, with all its inconveniences, rather than pay the three or four shillings a quarter that covers the rental of the electrical installation.

The object of free wiring is not philanthropy, but to sell electricity, and the installation that will use the greatest quantity of energy for the least expenditure of capital is the ideal subject for free wiring. Keeping this fact always in mind, the engineer will be very slow in accepting large houses or offices where early hours are kept. Shops, especially those that keep open late, or have a poor supply of daylight, are the most desirable, and since it is such consumers that generally benefit by any preferential tariff that is given by the supply undertaking, all the conditions are in favour of getting such users on to the mains.

Before considering the matter further, it will be well to see what are the rights given by statute to undertakings which have powers to do free wiring work.

Under Sec. 16 of the Electric Lighting Act, 1909 (9 Edw. 7, Ch. 34), "all electric lines, fittings, apparatus and appliances let by any undertakers on hire or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession shall, whether they be or be not fixed or fastened to any part of any premises in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and be removable by the undertakers, and Secs. 24 and 25 of the Electric Lighting Acts, 1882, shall extend and apply to all such electric lines, fittings and apparatus and appliances. Provided that such electric lines, fittings, apparatus or appliances have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon sufficiently indicating the undertakers as the actual owners thereof.

"For the purposes of this Section, electric lines, fittings, apparatus and appliances disposed of by the undertakers on terms of payment by instalments shall, until the whole of the instalments have been paid, be deemed to be electric lines, fittings, apparatus and appliances let on hire by the undertakers."

The provisions of the above Act give ample security to undertakings who do free wiring, for not only are their fixtures, which are on the ordinary hire system, perfectly safe from liability to seizure by either the landlord or the creditors of their consumer, but even apparatus on the hire-purchase system are secured till the final payment has been made. Care must be taken, however, to see that a metal plate bearing an inscription to show that the installation is a free wired one is always fixed in a conspicuous position as required by the Act. Many consumers object to this plate, especially in private houses, but this condition must be fulfilled if the free wiring department do not wish to prejudice their position in any claim for damages which may arise. A small plate fixed beside the main switch will be in the most conspicuous place possible for warning those who are about to alter the wiring, and yet it will be in a position that is not obtrusive, and to which even the most sensitive householder cannot take exception.

Undoubtedly the most satisfactory method of carrying on the work is for the electrical undertaking to open a free-wiring department and employ their own men; but while this may be the most satisfactory way, only undertakings which expect a large amount of work can afford to maintain a separate free-wiring department. It is courting disaster to tack this department on to one of the other departments of an electric supply undertaking, and expect that the head of that department will be able to give the time and attention to the free-wiring work that ought to be given to it. A successful free-wiring department needs a man to be in charge of it who can not only estimate for and carry out all kinds of installations, but who can also advise prospective clients how to obtain the best results from electric light for each particular case.

All installations should be maintained in a state ef efficient repair by the free-wiring department, without making any charge against the hirer for such work unless it be a case of wilful damage by other than electrical causes; most people prefer to know exactly how much the installation is going to cost them, and would rather pay a slightly higher rental in order to have the certain knowledge that there are no unknown liabilities to come on them from time to time. This maintenance should not include lamps or shades.

In towns where there are a number of good wiring firms, it is possible to contract the work out; this is an excellent way if the class of material is clearly specified. The work should be very carefully inspected as it proceeds, and the contractor should clearly understand, before his offer has been accepted, that any attempts to put in inferior material will result in his name being struck off the list of those who are asked to offer for future work. Since the free-wiring department must maintain the installation, it is evident that only firms whose work is known to be good can be allowed to quote, and the fact that there is such a list will be an incentive to the real contractors to do good work, and will also protect them from the competition of every ironmonger or tinsmith who chooses to call himself an electrical engineer, and whose low-grade material enables him for a short time to take away work from good firms. The most obvious objection to this method is the difficulty of arranging maintenance terms with contractors; but every electric supply undertaking of any size needs a good wireman on the staff: and this man can be detailed off to repair the defects which develop from time to time in even the best of installations.

The advantages of the system are that prices, and therefore the rental, can be fixed before the work is begun, with the certainty that the cost will not be exceeded; the free-wiring department will be saved the expense of carrying a heavy stock of material and also the fairly heavy oncost charges incidental to a contractor's business, without the ability to take on jobbing work at their own price; but the greatest advantage will be the elimination of the endless friction and distrust that is generated between contractors and even the most correctly conducted free-wiring department.

If local contractors show themselves willing to co-operate with the supply authority, it is often possible to allow approved contractors to canvass for free wiring on the distinct understanding that the work for each suitable installation that is accepted will be given to that wiring firm; if careful records of the cost of each job have been kept and tabulated, it should be possible to arrive at the cost per point of every type of installation, and from these gradually accumulating data contractors' estimates can be checked far more easily and with as accurate results as by any other method.

A joint exhibition held periodically in which all reputable contractors are asked to co-operate will help to stimulate business, and if the energy used is supplied at a nominal charge, or even free, it will encourage the connecting-up of all the apparatus on show and make the exhibition far more interesting to visitors.

The supply of fittings for free-wired installations is apt to lead to difficulties; the usual practice is to have standard fittings for each class of work, and if a consumer wants better ones he has to pay the difference in price. This works very well until a change of tenant takes place; then it is necessary to settle who is to have the fittings. The consumer does not want to buy them out completely; nor does the supply authority, and a new tenant usually desires fresh fittings or a rebate on the rental due to depreciation of fittings. The only safe method of dealing with fittings is to make consumers either supply their own or else buy them outright from the supply authority. The free-wired installation should cease at the ceiling roses, and the con-

sumer should pay for all fittings and pendants, including the erection of the same ; then when the premises are given up there is no dispute as to the ownership of the fittings, nor is the free-wiring department saddled with a quantity of tarnished fittings which have not been on hire long enough to repay their first cost. The new tenant also will be able to arrange for the erection of such fittings as will suit his business best without either running up the rental of the installation or causing a loss to the wiring department.

The hire of fittings has been the cause of heavy loss to some of the earlier free-wiring departments, and the method outlined above has been adopted with marked success by a number of undertakings. The same principle should be adopted when hiring out motors ; the rental should include for the motor, slide rails, starting switch, D.P. switch and fuses, but the hirer should pay outright the cost of the foundation and the wiring to the motor.

The hire agreement between the consumer and the wiring department should be brief as well as clear, and the following condition should always be included, namely, that if the installation be damaged or destroyed by fire caused by other than electrical causes, the consumer must make good the cost of the damage. This provision induces the hirer to include the installation in his fire-insurance policy at a trifling cost to himself, and saves the wiring department from taking out a large number of separate policies.

Also the agreement should be binding on the consumer for a period of at least 12 months, and for such longer time as he remains tenant of the premises. The second clause is important, because cases have been known in which an unscrupulous tenant on a long lease has threatened to go back to gas, and keep the installation idle during his tenancy unless the rental agreed upon was reduced. Sometimes a new tenant coming into a free-wired installation tries the same game before signing the agreement ; in such cases it is vital to maintain a firm stand against any reduction. It would be far better to lose the rental of one or even more installations, rather than open the way for the wholesale squeezing of the free-wiring department—for the news soon spreads.

Extra work to an existing installation should be paid for outright, and not by increasing the rental. It is a safe rule never to increase the rental unless the installation is being extended. Work done on an installation in changing the position of switches, lights, &c., to suit structural alterations, will increase the cost of the installation, but not its value to a future tenant ; therefore it is neither just nor sound policy to raise the rental. On the other hand, if structural alterations are being made for an incoming tenant, the wiring department must be prepared to adapt the installation free of charge, so that the cost to the tenant will not be more than if there had been no installation in existence, and he had applied for a new free wire.

It is by using common sense, and taking care at least to appear reasonable in dealing with its consumers, that a free-wiring department will win confidence, and thereby be enabled to extend the use of electricity, and so bring up the load of the supply undertaking, which, after all, is the only reason for the existence of a free-wiring department.

A 10,000-kw. Generator. — The greater efficiency, reduction of losses and compactness of the power station gained by the use of large electric generating units have led to the installation of machines of unusual capacity in some of the great power stations. The General Electric Co. recently shipped to the Pennsylvania Water and Power Co., McCall Ferry, Pa., a three-phase, 10,000-KW., 11,000-volt water-wheel-driven alternator designed to operate at a speed of 94 R.P.M. The shipping weight of this unit was approximately 700,000 lb., and 15 cars were required for its transportation. It is 27 ft. in diameter and 10½ ft. high. A duplicate is now being shipped. Three 7,500-KW. generators of the same type, also of General Electric manufacture, are now in service n this plant.—*Electrical World.*

HIGH-VOLTAGE RAILWAY MOTORS FOR DIRECT-CURRENT WORKING.

By E. V. PANNELL.

In view of recent radical tendencies in the electric railway field, particularly as regards alternating-current traction motors with line voltages in the neighbourhood of 6,000 to 10,000, it is remarkable that so little reform has been introduced into direct-current working. So thoroughly has the potential of 500-600 volts become standardised that it has naturally been assumed, by partisans of rival systems, to represent the limiting line voltage for a direct-current system. Investigation will show, however, that, like many of our "standards," this is founded upon a fetish of the early restricted days of the industry. Where tramways or railways run upon or across public roads, the above-mentioned voltage represents a limit reasonably consistent with the safety of the community ; but where, as is usual in British railway practice, the road is laid from end to end upon private ground, and where due precautions are taken at stations and halts, a tenfold increase of voltage need not be considered unsafe.

Without venturing too far upon a controversial subject, it may be granted that, for such types of line as are operated electrically in this country—that is, suburban lines with frequent stops and interurban lines up to 50 miles in length —there is no preponderating advantage in the use of either direct or alternating current for the train motors. At the same time, the latter has advantages, due to the higher trolley potential. Let it be granted, therefore, that railway systems can be, and are, successfully run with direct current at a voltage of 500 to 600. Any increase of the voltage above this will bring about economy in the line copper and sub-stations proportional to the square of the increase ; so that, provided a practicable high-voltage railway motor be forthcoming, the success of a moderate potential railway will be enhanced in this proportion. The only problem involved, therefore, is that besetting the design of such a motor, and the object of the following investigation is to outline the main features of its design.

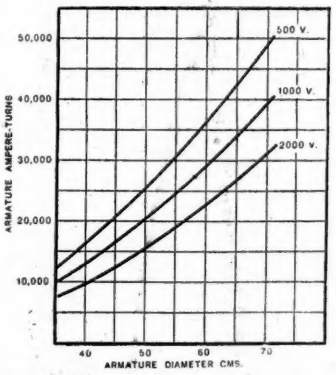


Fig. 1.—Armature Strengths for D.C. Railway Motors.

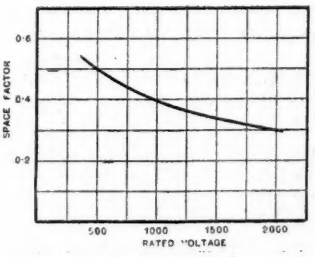


Fig. 2.—Space Factors for Armature Slots.

Although far less data are available on railway motors than on electrical machines of other form, the traction motor has, due to certain conditions, become crystallised into a standard type, from which there is very little departure. Treating of motors designed for service under a standard gauge railway coach, the limiting available dimensions are the principal factors influencing the design. The armature core length, after making allowance for gears, journals and commutator, is in motors of 150 to 250 rated H.P. limited to a maximum of 38 centimetres.* For similar reasons the maximum armature diameter is about 60 per cent. of that of the driving wheel. Matters are in a measure simplified by these limitations, as it is essential in large railway motors to utilise the maximum possible gross core length in the interest of getting a reasonably small driving wheel.

* See Electrical Review, Vol. LXIII, page 985.

The average speed of railway motors at rated load may be taken at 550 R.P.M. Continental designs are frequently higher, but the above figure is standard for British and American practice, and with a normal saturation curve does not lean towards undesirably high peripheral speeds when "free-running." So much being assumed, it remains now to consider the electrical and magnetic factors of the design, and to ascertain in what manner these will be influenced by an increase in the rated voltage.

The upper curve in fig. 1 shows the variation of armature

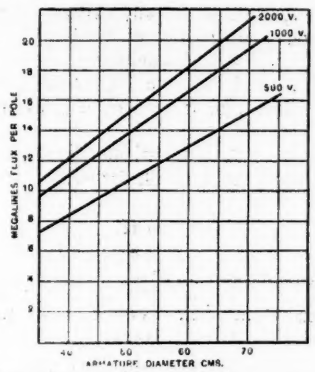


Fig. 3.—Field Strengths for H.V. Railway Motors.

ampere-turns with the diameter. The values there plotted have been taken from a number of the most up-to-date railway motors now operating at the 500-600 volts potential. Improved ventilation in the larger motors due to higher

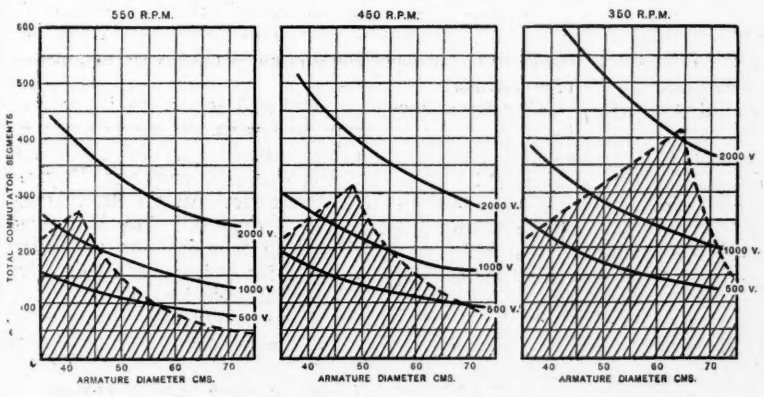


Fig. 5.—Number of Commutator Segments Required.

peripheral speed and better slot utilisation permits of a slightly increased loading per unit of circumference. The form of curve is exactly similar to one relating to direct-current generators; the values are considerably higher in accordance with the "one-hour 75 degree rise" system of rating.

The two lower curves, considered in relation to the diagram of slot space-factors (fig. 2) are self-explanatory. With increase of rated voltage a larger proportion of the slot area must inevitably be devoted to insulation and less to active material. The values of space factor plotted are figured with a view to low first cost, and as is usual in the type of motor under consideration, relate to armature conductors of rectangular cross-section. Where more expensive slot-lining materials may be employed, these values for space factor are susceptible of improvement. Nevertheless the values shown are not unduly conservative, whilst the use of compressed mica troughing or silk insulation is not called for.

In the lowermost curve of fig. 3 is demonstrated the variation of field flux per pole with armature diameter. These values relate to a pole shoe equal in axial length to the armature core and using the high values for pole face density in common use. In railway motors for suburban and interurban service where frequent stops have to be

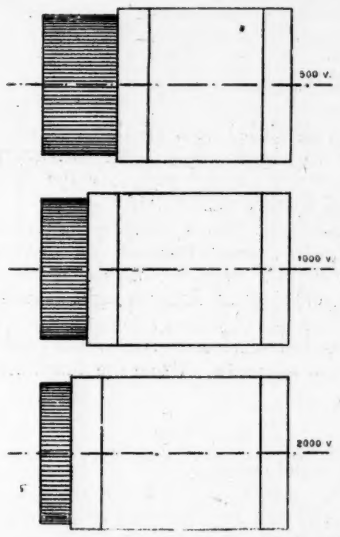


Fig. 4.—Relative Proportions for Armatures.

faced, high degrees of saturation form a vital feature of design. Not only does this improve the commutating constants, but also the shape of the speed curve. Considered from the same standpoint as stationary electrical machines, the armature strengths of railway motors, expressed in armature ampere-turns per pole, are abnormally high. This being so, it is obvious that, for a given output, the higher the field strength and the lower that of the armature, the more satisfactory will be the design.

The influence of the higher rated voltages on the magnetic loading may now be studied, and in this question the problem of commutator dimensions is involved. In the standard figure for gross length of armature core, hitherto assumed at 38 centimetres, a liberal allowance has been made for a length of commutator of 25 centimetres, this being quite in accord with motors of up to about 250 rated H.P. capacity. Allowing 20 per cent. lost space, this gives 20 cm. as the actual working length of the commutator. Now, inasmuch as with increase of rated voltage the current for a given output will decrease in inverse ratio, the axial length of the commutator may be decreased in the high-

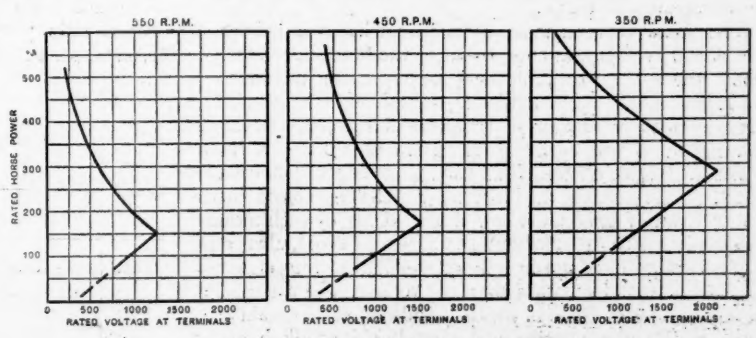


Fig. 6.—Limiting Rated Outputs.

voltage motors, and the space thus gained can be added to the core length. By this means a greater polar surface is obtained, and, consequently, increased strength of the field component.

The diagram (fig. 4) shows the relative dimensions of

the armature for a motor of about 250 rated horse-power on the above assumptions. The principal measurements are as follows :—

TABLE I.

	500 *volts.*	1,000 *volts.*	2,000 *volts.*
Armature diameter... ...	50 cm.	50 cm.	50 cm.
Gross core length	38 ,,	48 ,,	53 ,,
Length over windings ...	58 ,,	68 ,,	73 ,,
Commutator diameter ...	46 ,,	46 ,,	46 ,,
Commutator working length	20 ,,	10 ,,	5 ,,
Commutator gross length ...	25 ,,	15 ,,	10 ,,

It should be mentioned that all the foregoing deductions have applied to motors constructed with interpoles, and allowance has, therefore, been made for the shortened pole arc necessitated by this construction.

The most important part of the design, that of the commutator itself, now demands consideration. As regards the number of turns per segment, in all railway motors of 100 rated H.P. and upwards, this is brought down to the minimum. One turn per segment gives the minimum reactance voltage and at the same time the lowest possible voltage between adjacent segments. Using the fundamental voltage formula :—

$$V = 0{\cdot}04 \frac{T}{2} n M,$$

where V = internal voltage at rated load ;
T = total number of turns on armature ;
n = number of magnetic reversals per second ;
M = flux in megalines per pole

the number of turns on the armature can be found. Then as the relation between M and the armature diameter is already known (fig. 3), the relation between the armature turns or commutator segments and the diameter can be deduced. These values are plotted in fig. 5 for two circuit armatures at different rated speeds and voltages. The reasons for the inclusion of lower speeds than the standard one of 550 R.P.M. will later appear.

There are two limits affecting the number of commutator segments which can be employed for a given armature diameter. It is not permissible that the commutator diameter should exceed a value of 4 centimetres less than that of the armature. Hence with increasing numbers of segments and limited diameter, a point will be reached where the segment is too thin to be practicable. The minimum desirable width of segment and mica has been taken at 4·5 mm. Nothwithstanding the fact that narrower segments are in use, it is believed that this figure represents the minimum width consistent with a really satisfactory design. Under these conditions, the rising dotted lines have been plotted in fig. 5 to represent the maximum allowable number of segments. On this assumption, therefore, only those designs falling below the dotted lines are practicable.

The limiting factor in the other direction is the allowable voltage between adjacent segments which fixes the minimum number of segments. The drooping dotted lines in the diagram represent the limiting minimum number of segments, corresponding to a voltage per segment of 20. Experimental tests have shown it to be possible to work considerably in excess of this, but it is again a point where conservatism is desirable.

The space between these dotted lines has been hatched, and it will be seen at glance that, on the foregoing assumptions, the only practicable designs are those within the shaded areas. In other words, any combination of armature diameter with a number of segments falling outside these limiting areas will either necessitate a segment less than 4·5 mm. wide, or else call for a voltage per segment in excess of 20. The reason for the inclusion of such speeds as 450 and 350 R.P.M. at rated load is now clear. Only by such means can the limits be extended and the low-rated speed, always a feature of good design in railway motors, becomes of vital importance with increase of the rated voltage. In the design of any class of machine in which it is desirable to obtain the best possible commutation and least liability to flash over, low-rated speed is essential. The phenomenon of flashing over, while all its contributory causes may not be known, is indubitably a high-speed condition. Interpole motors are stated to be relatively free from this trouble ; the writer believes that the additional care bestowed on the design and insulation of a *low-speed* high-voltage motor will reduce it to a minimum.

The diagram (fig. 6) is deduced from the last figure by combination with the curves for ampere-turns and pole flux, and by the assumption of representative values for efficiency. The "peaks" enclose all those designs which are practicable, according to the assumptions set forth above. It is in no wise intended to imply that designs selected outside these areas are absolutely impracticable, but it is impossible for them to perform really excellently. It should be borne in mind that the railway motor is an extremely hard-worked piece of machinery. Its reactance voltage at rated load is of the order of four times that of a moderately good generator, whilst the sparking at all loads is far more violent than would be permitted in any other type of machine. Hence the reason for the use of moderately conservative commutating constants throughout this article, the adoption of which will ensure a high-voltage direct-current motor, which will operate at least equally as well as a low-voltage design.

It will be of interest to investigate slightly the maximum voltage motors which can be built for each of the three rated speeds :—

TABLE II.

Speed at rated load	350 R.P.M.	450 R.P.M.	550 R.P.M.
Maximum rated voltage ...	2,150	1,500	1,250
Rated output (one hour rating)	290 H.P.	175 H.P.	150 H.P.
Armature diameter	64 cm.	48 cm.	42 cm.
Minimum driving wheel diam.	40½ in.	30 in.	26½ in.

The armature and driving-wheel diameters for the low-speed motor tabulated above are such as to preclude its use for short-haul suburban service, where, due to the high rates of acceleration employed, it is necessary to reduce the weight of the rotating parts to a minimum. For medium-distance passenger traffic, this should prove a really excellent motor, particularly if designed with a fairly flat speed curve. Such service as is handled by the express trains between Liverpool and Southport on the Lancashire and Yorkshire Railway could be well taken care of by such a motor as this, whilst the increased line voltage would mean practically the elimination of sub-stations.

Thus far, nothing has been said as regards the type of motor employed for locomotive work, but it may safely be asserted that the difficulties attending the design of such a motor are less than those which beset the car motors. Further, it is by no means an established fact that the elecric trains of the future will be locomotive hauled. The locomotive whether steam or electric, suffers from inherent limitations which do not apply to a motor-car train where the motive power may be always proportional to the load.

Analysis of the high-voltage railway motors running at the present day is somewhat disappointing. In some cases the carcase of a standard 500-volt motor is adapted for the needs of 1,000 volts, its speed at rated load is increased by about 100 R.P.M., and its rating reduced by 45 per cent. Almost all designs reveal what seems to the writer an undesirably high speed at rated load. It is, however, a great satisfaction to know that more and more motors of voltages in the neighbourhood of 1,200 are being put into service with extremely favourable results.

Appended is a table giving the chief particulars of direct-current railway motors operating at not less than 1,000 volts terminal pressure :—

TABLE III.—Data of High-Voltage Direct-Current Railway Motors.

Rated voltage.	Makers.	Rated H.P.	Speed at rated load, R.P.M.	Weight of motor and gearing, tons.	Railway.
1,000	Siemens-Schuckert	130	720	1·57	Cologne-Bonn, Prussia
1,000	,, ,,	160	630	2·50	Moselhütte-St. Marie (narrow-gauge mineral line)
1,500	,, ,,	20	850	1·05	Experimental
1,600	J. J. Rieter	75	430	1·75	Bellinzona-Mesocco, Switzerland
1,200	General Electric Co., Schenectady	75	620	1·70	Central California Traction Co.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment No letter can be published unless we have the writer's name and address in our possession.*

New Steamship Line to Siberia.

It may interest you to hear that we are at present establishing a steamship line from this country to the mouth of one of the principal rivers in Siberia for the export of European-made goods and import of Siberian produce. Our first steamer will sail in June this year and will return in October. We have had our investigations going on throughout Siberia for the last two years at the expense of nearly £10,000, and have ascertained the great variety of European-made goods which are actually consumed and which may be sold regularly in certain quantities. At the same time, we have made the experiment that a lot of articles which are not known there, at the present, may be disposed of, and it has struck us that it would be to the mutual interest of your journal and your subscribers that the latter may be informed through your medium, either by publication in your paper or communication by letter, that we are open to receive offers and samples of such articles which your subscribers export to European Russia, as we are assured that in the majority of cases these may also be introduced to Siberia.

In a great many cases import of this description into Siberia has been prohibited because of the very high rate of freight on the Trans-Siberian Railway, which at present furnishes the only means of conveyance to and from those quarters. We may say, however, that, through having our own facilities of transport by sea all the way, and through the support of the river service on the Yenisei, we are in a position to effect the transport at a fraction of the rate on the railway.

The Siberian Steamship Manufacturing and Trading Co.
JONAS LIED, *Manager.*

117, Kensington High Street, W.,
April 26th, 1911.

Daylight "Saving."

Permit me to thank you for your excellent article on the subject of "daylight saving." It is comforting to get some common-sense on the top of all the nonsense which has been written about the daylight saving, and I hope it will have the effect of saving the British from being judged by the sayings of such faddists as the promoters of the Bill.

The only wonder is that they have been able to get so many otherwise sane people to believe in the idea.

J. C. C. Nielsen.

London, *April 29th*, 1911.

Steel Chimneys.

In reply to your correspondent signing himself "H. A.," I certainly did not intend to imply that the erection of a 100-ft. chimney in less than a month was anything very remarkable. Such a chimney could be built in considerably less time if desired. Using any of the recent types of compressed air paint-spraying nozzles, the chimney could be painted in a day or less.

Steel chimneys and reinforced concrete chimneys (the latter are of greater importance than the former in some applications, but their treatment lay outside the scope of my article) have certainly "come to stay."

Steel chimneys have an ever-widening sphere of utility, and are becoming increasingly common in all parts of the world. If properly tended, their deterioration need not be such a serious item as "H. A." will have us believe.

From his concluding paragraph, I should say "H. A." does not fully appreciate the extent to which reinforced concrete stacks are already used. To say that brick and mortar chimneys are necessarily "standard" practice or the only "satisfactory and economical" type in any particular application to-day is dogmatic.

K. Trowbridge.

London, N.W., *May 1st*, 1911.

Electricity Meters.

In your last issue Mr. Sharp asks why, in the diagram you were good enough to publish for me recently, I accepted Messrs. Ratcliff and Moore's curves for mercury motor, but not for commutator, meters. The reason is that I have first-hand information in the latter case, but not in the former.

I am sorry he does not understand my curves. There are none so deaf as those that will not hear. Perhaps he does not know that a difference in temperature of 1° C. makes a difference of almost ·35 per cent. in the readings of the mercury-motor meter, so that, however carefully it be calibrated, a rise or fall in temperature of barely 7° puts it outside of Board of Trade limits?

R. H. Barbour.

London, S.W., *April 19th*, 1911.

No Red Tape.

I have been struck with the very clever way a certain firm are selling cigarettes and tobacco, whereby all their customers must become canvassers.

Suppose an electricity company sold electricity at 4d. per unit, and said to every customer, "When you can bring me six application forms for six new consumers your electricity will be reduced to 3½d. per unit." What would happen? Ten shopkeepers get their price reduced for getting 60 new consumers! The 60 new consumers get their price reduced for obtaining 360 new consumers!!! You all know what happened when, as boys, you started with the small stock of two white mice!

White Mouse.

[But, apart from the question of dignity of procedure, a serious matter to some engineers, how would this square with the law regarding preferential rates?—EDS. E.R.]

Re Copyright and Patents.

With reference to your leading article the other day in connection with the Copyright Bill, might I respectfully point out that you quite misunderstood Mr. Balfour's explanation of the difference between a copyright and a patent. Briefly, the distinction is that in the case of a patent nobody may make any use of it without compensation to the inventors, whereas in the case of, say, a book the information contained therein can be made use of by anyone in practically any way—even to its being embodied in another book. The distinction to me seems to be sufficiently obvious, and to clearly show the necessity for a different reward in the case of a patent and copyright.

With regard to your remarks in connection with the Patent Law, far be it from me to protect the English system of patents; but as far as your praise of the American system is concerned, I seem to remember reading an alleged interview with Mr. Edison, who expressed a strong preference for the English law as compared with the American. It is certainly a scandal that profits should be made by the State out of inventors, but I do not think that the number of inventions is likely to be affected by their doing so, provided the amount is not greater than at present.

J. S.

Cord Grips.

With reference to the interesting article by Mr. G. W. Western on cord grips and flexibles in this week's issue of the REVIEW, we can only assume that the writer must be unfamiliar with the device we have had on the market some seven or eight years, and of which many thousands have been sold. We refer to the Protector cord grip, page 47 in our catalogue (a sample of which we send you), which fulfils Mr. Western's suggestion, with the advantage that it is, of course, very much neater, being moulded from vulcanised rubber, and is a good insulator.

There is no question that the adoption of black sticky tape, as suggested, would look very ugly in shop windows and offices, particularly as the dust would adhere to this tape.

We think, however, that a better method is the Isogrip lampholder, which has been adopted on very important Government work, shipbuilding yards, factory and shop work, as by the Isogrip method the dangers referred to by Mr. Western are totally abolished.

Ward & Goldstone.

Manchester, *April 28th*, 1911.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The annual Festival Dinner of the Electrical Trades Benevolent Institution was held at the Hotel Cecil on Wednesday evening, the 26th ult. Lord Justice Fletcher Moulton, K.C., F.R.S., presided, and there were about 130 persons present, including such well-known gentlemen as Mr. J. S. Raworth, Mr. H. Hirst, Major W. A. O'Meara, Messrs. J. E. Kingsbury, Justus Eck, H. Berry, F. H. Nalder, E. Garcke, A. J. Walter, K.C., H. Bevis, H. W. Butler, R. J. Wallis-Jones, W. R. Rawlings, C. Wilson, J. J. Steinitz, W. R. Cooper, Guy Burney, A. H. Preece, W. Davenport, J. H. Bowden, A. T. Turney, and F. B. O. Hawes (Secretary).

After the usual loyal toasts the President proposed the toast of the evening, viz., that of the Electrical Trades Benevolent Institution. After referring to the absence of Sir William Preece—who had from the beginning taken the deepest interest in the affairs of the Institution—owing to his visit to South Africa, the President told how he was himself indebted to Sir William Preece for his introduction to electrical work in the far-off days when the question at issue was whether a telephone message was to be regarded as a telegram or not. Since that time he had watched the growth of the industry to its present importance, when it seemed likely that it would monopolise nearly the whole of the higher class work of the world. It almost seemed that some day it would be able to say to the rest of the world, "Develop your brute force, leave the rest to me." The requirements of electrical work demanded trained intellects for not only the superior, but many of the subordinate posts. There were almost as many officers as men. This Institution endeavoured to meet the wants of this particular set of conditions. It was able to test individual cases, and, at the same time, to help without causing any loss of self-respect. The management was in the hands of the trade, who gave their services gladly, so that practically all the money contributed would go straight to its good end. He was glad to be able to speak in its favour. The fund they were called together to support had been in existence for five years, and according to its rules might now be called on to grant pensions to deserving cases. The Institution now had obligations as well as privileges, and he was sure that the appeal for funds to meet them would not be made in vain. All should join, because all ran risks, and none knew who might be the next to fall. Many failed through no fault of their own, and it should be a privilege for all to contribute as they were able to a fund such as this.

Mr. H. Hirst, in supporting the toast, said that the Institution had a capital of about £2,000, and an income of about £400. The industry had about 100,000 members; none were millionaires, but there were a large number in comfortable circumstances. It was to them he made his appeal. Either as firms or as individuals they might contribute to the funds of the Institution, and place it in a position to do its work. Misfortune came to many, and often a little brotherly help and sympathy were of untold value. One was apt to think that if a man was down it was his own fault, but his experience was that very often it was not so. At any rate, it was their duty, as well as their privilege, to help such cases. As a means towards making the work of the Institution better known, he suggested that firms should subscribe £10 or £5 5s. each, and that the technical Press should be asked to publish from time to time lists of subscribers as an encouragement to others.

He also recommended that in each undertaking one member should be encouraged to act as voluntary collector from his colleagues on behalf of the fund, and said that it might be well to award prizes to be distributed at the Festival Dinner in each year to those who specially distinguished themselves in this direction.

Mr. A. J. Walter, K.C., also gave his approval to the fund. He said that in their early days they were naturally inclined to look on the bright side of things, but in the electrical as well as in the legal profession there were many who, through no fault of their own, failed to achieve the goal of success. It was, therefore, specially necessary that all should make provision for the future, for themselves as well as for others. When, at the end of life, all balance sheets were made up, what would be their excuse if theirs were only a selfish one? To whom should their friends look if not to their brothers in arms for help in time of temporary disablement? Many a time a helping hand at such a crisis had done untold good. He was pleased to see that the management of the fund was entirely in the hand of the members, and he most heartily commended it to all engaged in the industry.

Mr. R. J. Wallis-Jones proposed the toast of "The President," who, in replying, gave the following gratifying report of the progress of the fund since the beginning of the present year:—

Total subscriptions, including those given that night	£49	6	0
Total donations " " "	476	11	6
Making a total of	£525	17	6

as compared with £320 given up to the corresponding date last year. There was also a sum, estimated at about £380, shortly available as a balance from the last Olympia Electrical Exhibition, which would still further increase the resources of the fund. It was earnestly hoped that further contributions would be given, so that the sum available for distribution should be considerably increased.

During the evening an excellent programme of music was performed.

The following is a list of donations and subscriptions received or promised at the Festival Dinner The subscriptions are marked with an asterisk :—

Rt. Hon. Lord Justice Fletcher Moulton	£10	10	0
Bazire, A.	1	1	0
Kingsbury, J. E.	1	1	0
Buck & Hickman, Ltd.	1	1	0
Sterling Telep. & Elec. Co.	3	3	0
Burney, Guy	*2	2	0
Handcock & Dykes	*1	1	0
Webb, J. W.	1	1	0
London Electric Firm	2	2	0
Peel, C.	*0	10	6
Wilkinson, H. D.	*1	1	0
Steinitz, J. J.	*1	1	0
Siddeley, H. C.	*1	1	0
Levinger, Max	*1	1	0
Hextall, G. B.	*1	1	0
Overlander, Otto	*1	1	0
Armorduct Manufacturing Co.	*2	2	0
Schmahl, W.	*2	2	0
Goddard, J. T.	1	1	0
Spicer & Pegler	1	1	0
McDougall, Ltd.	1	1	0
Thurnauer, L.	1	1	0
Tasker, W. Howard	1	1	0
Wolf, A.	1	0	0
Barfield, E. P.	1	1	0
Thomson, W. C.	1	1	0
Raworth, J. S.	2	2	0
Eck, Justus	2	0	0
Nalder, F. H.	1	1	0
Garcke, Emile	5	5	0
Hart Accumulator Co., Ltd.	10	10	0
Boulton, G., & Sons	0	10	6
Lock, Lancaster & Sons, Ltd.	1	1	0
Spies Bros. & Co.	1	1	0
Hurst, A., & Co.	1	1	0
Wallach Bros., Ltd.	1	1	0
Holmes, F. J.	1	1	0
Brundle, F. H.	0	10	6
Hay, G.	1	1	0
Worrell & Baynes	0	10	6
Esdaile & Co., Ltd.	1	1	0
Meyer, M. L.	0	10	6
Clark, E. J.	1	1	0
Tasker, W. H.	£0	10	6
Blackwood, J. A.	2	2	0
Cooper, W. R.	2	2	0
Walter, Arthur J.	5	5	0
Howe, J. W.	0	10	6
Greene, F. A.	1	1	0
Harris, A. F.	0	10	6
Hecht, J. S.	1	1	0
Pell, W. M. D.	1	1	0
Jandus Arc Lamp and Electric Co.	2	2	0
Gibson, J. D.	*1	1	0
Longbottom, B.	*2	2	0
Berry, H. H.	*1	1	0
Attwood, Reginald G.	0	5	0
Benest, F. E.	1	1	0
Bevan, Edward	0	5	0
Raphael, F. C.	1	11	6
Sanderson, C. F.	0	10	0
Jacobs, C. M.	0	10	6
Benjamin, H. L.	2	2	0
Samuelson, F.	1	1	0
Pirelli, Ltd.	2	2	0
Krausse & Auerbach	1	1	0
Hughman, R. W.	*1	1	0
Zettel, Theo.	0	10	6
Sheppard, E. G.	0	10	6
New, Max	1	1	0
Davenport, Walter	1	1	0
Rich, Theodore	0	10	6
Bright, Chas.	1	1	0
Murray, Ruthven	1	1	0
General Electric Co., Ltd.	31	10	0
Osram Lamp Works, Ltd.	26	5	0
Robertson Elec. Lamps, Ltd.	15	15	0
Aron Elec. Meter, Ltd.	10	10	0
Peel-Conner Telep. Works, Ltd.	5	5	0
Hirst, Hugo	10	10	0
Byng, E. G.	10	10	0
Brit. Thomson-Houston Co.	21	0	0
N. J. Fenner and H. B. Alder & Co.	0	5	0
Electrical Review	10	10	0
Sun Electrical Co.	5	5	0

In addition to the foregoing, the following subscriptions and donations have been received since December 31st, 1910, up to April 25th, 1911. Subscriptions are marked with an asterisk :—

Byng, Gustave, Trustees of the late	£100	0	0
Pilkington Bros., Ltd.	*0	10	6
General Electric Co., Ltd.	10	0	0
International Trades Exhibition, Ltd.	5	5	0
Ferranti, Ltd.	*5	5	0
Bishop, O. H.	*1	1	0
Ruberoid Co., Ltd.	*1	0	0
Kapp, Gisbert, Dr.	*1	1	0
Samuelson, A. G. B.	*2	2	0
Hunt & Co., R., Ltd.	*1	1	0
Golden, R. E.	0	10	6
Home & Rowland	1	1	0
Stolzenberg Patent File Co.	1	1	0
Baughan, A. H.	0	10	6
Moul, H. E.	1	1	0
Facsimile Letter Printing Co.	0	10	6
Cantie Switch Mfg. Co.	1	1	0
Wilcox, W. H., & Co., Ltd.	*2	2	0
Marshall, E.	*0	10	6
Reynolds, T., & Co., Ltd.	0	10	6
Waddie, T., & Co., Ltd.	0	10	6
Redmayne, L.	0	10	6
Crampton & Sons, Ltd.	*0	10	6
Hardy & Padmore, Ltd.	0	10	6
Thacker, F. C.	0	10	6
Barkham, C.	0	10	6
Wedekind, J. E.	0	10	6
Conradty, C.	3	0	0
Sloan Electrical Co.	2	2	0
Unwin Bros., Ltd.	1	1	0
Glaholm & Robson, Ltd.	0	5	0
Turners & Manville, Ltd	*1	1	0
Champion, H. C.	0	5	0
Chaplin, H., & Co.	1	1	0
Gabriel Lamp Co.	0	10	6
Leftwich & Co.	0	10	6
Cook, A. G. H.	0	5	0
Voigt & Haeffner	2	0	0
"Anonymous"	0	10	0
Korting & Mathieson, Ltd.	2	0	0
Wearing, A. B.	0	2	6
Hartmann & Braun, Ltd.	2	0	0
Hall, J.	0	10	6
Courtenay, J. Irving	5	5	0
Ward & Goldstone	5	0	0
Barry, Sir J. Wolfe	*1	1	0
Trotter, A. P.	1	1	0
Pilkington Bros., Ltd.	1	1	0
O'Meara, Major W. A. J.	2	2	0
Wallis-Jones, R. J.	1	1	0
Anderson, A. Bruce	2	2	0
Ireland, A. J.	1	1	0
Traun, Dr. Heinz, & Sons	2	2	0
Devonshire, J.	2	2	0
Parsons, Hon. C. A.	1	1	0
Courtenay, Sir J. Irving	5	5	0
British Ever-Ready Elec. Co.	5	5	0
Tegetmeier, C. G.	1	1	0
Lycett, J. A.	1	1	0
Blackburn, Starling & Co., Ltd.	2	2	0
Leaf, H. M.	1	0	0
Lund, P., Humphries & Co., Ltd.	0	5	0
Thompson, W. P., & Co.	1	1	0
Spencer, Sir Ernest	£1	1	0
Espir, Fernand	*1	1	0
Straus & Co.	*1	1	0
Rich, Theodore	*0	10	6
Clothier, H. W.	0	10	6
Lind & Co.	*1	1	0
D.P. Battery Co.	0	10	6
Griffiths Bros. & Co.	1	1	0
Mosers, Ltd.	0	10	0
Harris, W. G.	0	10	6
Preece, A. H.	1	0	0
Indestructible Cable Co.	1	1	0
Preece, Cardew & Snell	2	2	0
Geipel, W.	5	5	0
Morrison, Alexander	0	10	0
Garbe, Lahmeyer & Co.	2	0	0
Wood, L. A. S.	0	5	0
Bates, W. A.	0	2	6
Edgcumbe, Kenelm	0	10	6
Arculus, Alfred, & Co.	1	1	0
Burman, R. H.	0	10	6
Ellis, Simpson & Saunders	1	1	0
Wilkins & Wright	1	1	0
Assersohn, D.	0	10	6
Manifold Printing Co.	1	1	0
Berridge, Geo., & Co.	2	2	0
Becker, R.	0	10	6
Waterhouse, L. M.	*1	1	0
Carless, Capel & Lennard	1	1	0
Continental Tire Co.	1	1	0
Crapper & Co.	0	10	6
Escare & Denelle	0	10	6
Price & Co.	1	1	0
Rawlings Bros., Ltd.	2	2	0
Wiggins & Co.	0	10	6
Northcote, C. S.	1	1	0
Bagley & Co., Ltd.	0	10	6
Mehne, J. G.	2	0	0
Jaeger Bros.	1	1	0
Falk, Stadelmann & Co.	5	0	0
Digby, T. J.	5	5	0
Stubbs, A. J.	1	1	0
Bonnella, D. H., & Son, Ltd.	1	1	0
White, S. D.	1	1	0
Taylor, Tunnicliff & Co., Ltd.	1	1	0
Charles & Dible	1	1	0
Sykes, Geo.	1	1	0
Charles, W. J.	1	1	0
Madgen, W. L.	1	1	0
Howley, R. J.	1	1	0
Farmiloe, T. & W., Ltd.	1	1	0
Grothe & Son, A.	0	10	6
McGeoch & Co., Wm., Ltd.	2	2	0
Canning & Co., W.	0	10	6
Straus & Co., G.	0	10	6
Broadbent, F.	0	10	6
Dennis, R.	0	7	6
Cohen, A.	0	5	0
Catchpole, J. W.	0	10	6
Stewart, A.	1	1	0
Whittaker & Co.	0	10	6
Kolle, H. W.	2	0	0
Baker, G. T.	*1	1	0
Croggon & Co.	*1	1	0
Reid, E. J.	*1	1	0
Saxonia Elec. Wire Co.	0	10	6
Brit. Traders' Association	*2	2	0
Hawes, F. B. O.	*1	1	0

These lists, we believe, will serve to indicate the wide-spread interest in and sympathy with the Institution that is now being manifested by those who are acquainted with its admirable aims and methods. We hope shortly to publish supplementary lists, including all contributions received during the next fortnight, and we cordially recommend the institution to our readers as being one which should appeal very strongly to their liberality, which is in need of their generous support, and which is in all respects worthy of their patronage

THE "THOMAS" TRANSMISSION FOR PETROL VEHICLES.

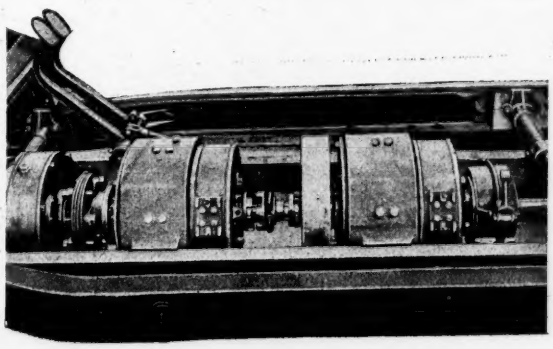
On Friday last, through the courtesy of the Thomas Transmission, Ltd., we were able to experience something of the joy of riding in a petrol-driven car, in which the operation of speed changing was not accompanied by gear changing, as generally understood—that is, the usual audible and physical accompaniments of this operation were absent.

The car, or rather cars—for there were two fitted cars on view, a 12-16-H.P. Delahaye touring car and a 30-40-H.P. Leyland lorry, at present undergoing a 2,000 miles test under R.A.C. supervision—were fitted with the Thomas transmission, an electro-mechanical system which allows a practically infinite speed variation and renders the full engine power always available, and which gives high and smooth acceleration owing to the elimination of the unmechanical gear box.

The Thomas arrangement, which is shown diagrammatically herewith, consists briefly of a simple planetary gear boxed in a casing D, which constitutes the engine fly-wheel; the larger sun pinion, W of the gear, is coupled through the inner driving shaft H direct to the road wheels; the smaller sun pinion W_1 drives through a hollow shaft K an electrical machine B B_1, which is electrically connected in series to a similar machine C C_1 mounted on the driving shaft H. If we assume the engine to be started, shaft H, due to the resistance to motion of the road wheels, will remain stationary, while the planetary gear will rotate shaft K with its armature freely in the opposite direction to the fly-wheel.

If the two electrical machines are now electrically coupled, C C_1, acting as a motor, exerts a driving torque on H, and the vehicle commences to move. Subsequently B B_1 slows down, owing to the braking effect of the growing load, causing the engine torque to be transferred through thd gear and pinion W direct to the road wheels, until the machine B B_1 and its shaft come to rest. From this point, the functions of B B_1 and C C_1 are reversed electrically, the latter acting as a generator, driving the former as a motor and assisting the main drive (shaft H) through the planetary gear, until the top speed is reached, when the coupling Q is engaged, and a direct drive from the engine follows, all electrical losses being eliminated. Obviously, by varying the gear ratio of the planetary motion, which, it will be noticed, consists of three equal-sized small and three equal-sized larger pinions, it is possible to adjust the size of the electrical gear so as to meet any particular requirement efficiently. The curve of transmission efficiency between engine and back axle is naturally rather a curious one; roughly taking a hypothetical case, it would start at about 80 per cent., at, say, 3 M.P.H., when the first electrical transmission was in use, rising gradually, as electrical losses disappeared, to about 94 per cent. at 7 M.P.H., when the functions of the electrical machines are reversed, and when it begins to fall again owing to increasing electrical losses with the second electrical transmission in use, falling to about 85 per cent. at 10 M.P.H., and from this point rising rapidly to 100 per cent.; representing direct mechanical driving at top speed, 12 M.P.H.

The electrical machines are of the six-pole constant-current totally-enclosed type, with the fields in series, the pressure being varied by diverters in each field; the switchgear is totally enclosed, and the speed control is by means of one lever working in a quadrant, marked with "reverse," "start engine," "neutral," speed notches one to nine, "top speed," and lastly, "charge batteries."



Planetary Gearbox and Electrical Machines, "Thomas" Transmission.

It is necessary to explain that a 12-volt battery is carried on the car for starting the engine, and for car lighting purposes; this battery is charged from machine B B_1, connected up as a shunt machine, when running on top speed, and since it is a low-voltage series machine, it can in turn be driven as a motor from the battery for starting the engine.

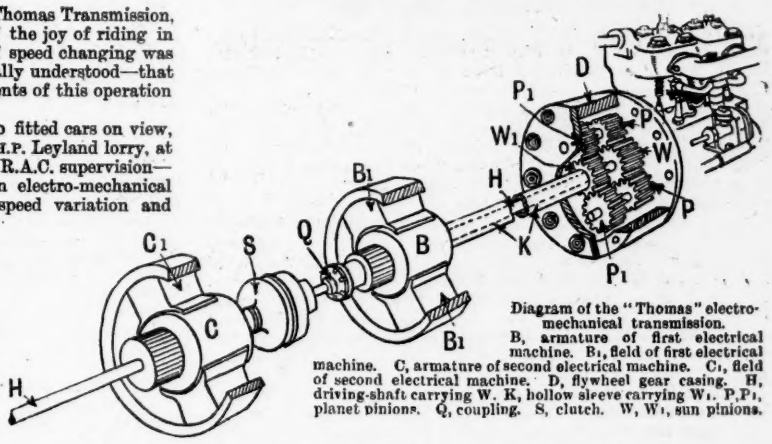


Diagram of the "Thomas" electro-mechanical transmission. B, armature of first electrical machine. B_1, field of first electrical machine. C, armature of second electrical machine. C_1, field of second electrical machine. D, flywheel gear casing. H, driving-shaft carrying W. K, hollow sleeve carrying W_1. P,P_1, planet pinions. Q, coupling. S, clutch. W, W_1, sun pinions.

Diagram showing "Thomas" Transmission System.

By the Thomas arrangement the reverse is also operated electrically; the dog coupling Q is engaged, clutch S is disengaged, and machine B B_1 driven by the engine, supplies current to C C_1, which, with a reversed field, drives H and the car in the reverse direction to normal.

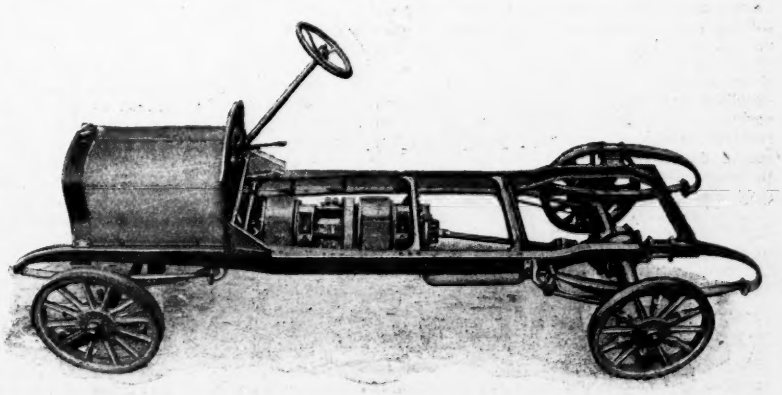
It should be noted that all the above operations—starting, changing speed, reversing, &c.—are performed by the single control lever mentioned, and, therefore, so far as the driver is concerned, the vehicle is much more easily and accurately controlled than with the usual change-speed gear arrangement.

Moreover, with the Thomas gear the additional features of electric lighting and self-starting of the engine are thrown in, and, therefore, the additional 3 or 4 cwt. introduced, as compared with the ordinary sliding gear box arrangement, will be pardoned, especially as a smaller engine can be used.

As regards the 30-40-H.P. lorry to which we have referred as under test—vehicle and test load being roughly 8 tons in weight—we were able to note the facility with which speed was varied during a run from Tonbridge to Sevenoaks, which includes a climb of some 500 ft. up Riverhill, part of which is a 1 in 6 grade.

The fairly regular sequence of notch numbers of the control lever, as speed decreased to between 2 and 3 M.P.H., and then increased to the normal 12 M.P.H., indicated the smooth deceleration and acceleration possible with this transmission. We understand that the lorry is running 10 miles to the gallon of petrol.

The gear is being fitted experimentally to a 25-H.P. 'bus, the 25-H.P. engine replacing a 30-H.P. engine usually fitted for this work; a 160-H.P. petrol-driven railway car is also being provided with this transmission.



Chassis, with "Thomas" Transmission Fitted.

China.—The British Consul at Shasi reports that a native company was recently formed for the installation of electric light works at Shesi and Tchang, and a contract has already been made with a foreign company for the supply of plant for 4,000 lamps at each place. It is said, however, that the capital has not yet been fully subscribed, and it is doubtful whether the scheme will go further at present.

LEGAL.

General Electric Co., Ltd., v. Evans.

This action was before the Divisional Court, consisting of the Lord Chief Justice, Mr. Justice Pickford and Mr. Lush, on the 27th ult., in the form of a special case stated by the magistrates of Aston, Birmingham.

At the Petty Sessions at Aston, on November 23rd, 1910, an information was preferred by Mr. Evans, an official of the Midland Railway Co., against the General Electric Co., of Witton, charging them with having attempted to evade the payment of certain tolls to the company by describing "ten electric stators," consigned in two parts, as "two cases bearers."

The General Electric Co. obtained a contract to supply for the use of the Bradford Corporation certain electrical machinery, including an alternator. This was consigned from Witton to Bradford, *viâ* the Lawley Street Station of the Midland Railway. According to the general classification of goods, "bearers" were chargeable at a lower rate than electrical appliances, the charge for the former being 9s. 2d. per ton and for the latter 22s. 9d. per ton. The General Electric Co. contended that they were entitled to consign the goods as "bearers," and submitted that as there was no rate fixed in respect of the consignment of a generator in parts between Bradford and Witton at owner's risk, there was no evidence in law of an offence under Sec. 99 of the Railways Clauses Act, 1845.

The Magistrates held that the General Electric Co. had given a false description of the goods consigned, with the hope of avoiding payment of certain tolls, and imposed a penalty of £10 10s. and costs. Against this decision they now appealed.

Their Lordships, being of opinion that the judgment of the Magistrates was right, dismissed the appeal with costs.

The Langdon-Davies Motor Co., Ltd.

In the Chancery Division, on the 28th ult., the debenture-holders' action, Cree *v.* The Company, came before Mr. Justice Neville, upon motion for judgment in default of defence.

It was stated that the company was incorporated in 1905 to acquire from a company with a similar name certain patent rights and property in alternating-current motors manufactured under the patent. In 1905 the company issued debentures to the amount of £5,000, which were duly registered. The principal money became payable in the event of a winding-up of the company, and the company had passed extraordinary resolutions for winding up voluntarily. The plaintiff was the holder of 300 £1 debentures.

There was no opposition, and his Lordship made the usual debenture decree, declaring the debentures a charge on the company's property, and directing the usual accounts and inquiries.

Sir Oliver Lodge's Petition.—Judgment.

Mr. Justice Parker, in the Chancery Division on Friday, April 28th, delivered his reserved judgment on the petition presented by Sir Oliver J. Lodge for an extension of the term of his patent for a wireless telegraph system No. 11,575 of 1897.

The petition was based on the ground that owing to a number of circumstances, the patentee had as yet received no remuneration for his invention, and Mr. Walter, K.C., and Mr. J. Hunter Gray appeared in support. The Comptroller-General of Patents was represented by the Solicitor-General (Sir John Simon) and Mr. Sarjant.

His Lordship prefaced his judgment by saying that by it he was suggesting the way he thought the matter ought to be dealt with under the circumstances of the case, but as the judgment dealt with one or two points that were not perhaps fully discussed at the hearing, he would listen to anything counsel might have to say after he had dealt with the case. In the system of wireless telegraphy protected by the letters patent under consideration, he said full use was made for the first time of the principles of resonance or syntony. The patentee had himself fully explained the difficulty of using this principle in 1894 in his well-known lecture before the Royal Institution. Electric oscillations in a good radiator were rapidly damped and did not, therefore, give rise to such a long series of waves as was required for the purpose, and, on the other hand, a receiver which was a good absorber of wave energy was, for that very reason, unable to accumulate the effect of a series of waves. The patentee solved the problem by a compromise between the radiatory or oscillating qualities of his transmitter on the one hand, and the absorbing and accumulating qualities of his receiver on the other. Sir Oliver Lodge was the first to realise that which was now beyond dispute, that a certain diminution in the radiatory qualities of the transmitter or of the absorbing qualities of the receiver would, so far as efficiency was concerned, be more than compensated for by the cumulative action of a series of waves, and further that by rendering his receiver responsive only to a train of waves he could tune out all sending stations which were not working with the same length of wave and so secure selectivity. The patentee effected that compromise by the introduction of an induction coil between the two capacity areas of his transmitter and receiver respectively. Thus, he not only diminished the natural frequency of his circuits, but he increased their electrical inertia. In that way he enabled the transmitting circuit to create, and the receiving circuit to accumulate, the effect of a series of waves as opposed to one or two waves of great amplitude. In the practical working of the system it was necessary to notice certain points. First, the coherer was removed from the path of the receiving circuit in which it would hinder the accumulation of the wave energy, and it was placed in a derivative circuit in which there could be an overflow of energy accumulated in the receiving circuit. Secondly, as great precision of tuning was required, the patentee provided an adjustable induction coil, or two or more induction coils, which could be switched in or out of circuit as desired, the object being not only to secure precision of tuning between the transmitter and a single receiver, but to enable the operator to adjust the transmitter to various receivers at different receiving stations and so get the selectivity he required. Thirdly, the patentee disclosed a means of bridging the spark gap of the transmitter so as to enable it when disconnected from the charging circuit of whatever instrument was employed, and when connected up to the coherer circuit, to be used as a receiver. Fourthly, the patentee conceived that the oscillations in the transmitter could be adversely affected by its metallic connection with the source of supply. He provided, therefore, means for charging the transmitter by impulsive rush without any metallic connection. He also conceived that the oscillations in the receiver might be adversely affected by its metallic connection with the coherer circuit, and he therefore linked the circuits of the receiver and coherer respectively by means of an ordinary transformer. With regard to the claims in the specification, the first and second related to the compromise he had referred to, and covered the introduction of inductance coils between the two capacity areas of both receiver and transmitter for the purpose of enabling the one to accumulate and the other to create the effect of a series of waves. The third, fourth and fifth claims related to the means employed by the patentee for tuning of the transmitter to a single receiver or different receivers at different receiving stations, and for enabling the same instrument to be used either as a receiver or transmitter. The sixth related to the means of charging the transmitter by impulsive rush without metallic connection with the source of supply. The seventh was for a combination including two capacity areas of a particular shape, means of tuning them, a coherer circuit completed through one or both of them and means for enabling the capacity areas to be used either as a transmitter or receiver. Claim eight was for a particular sort of coherer, which he gathered was not now in use. Claim nine related to the linking of the coherer circuit with the receiving circuit through a transformer to avoid metallic connection, ten was for particular arrangements at the receiving end, and 11 was for the arrangements and combinations constituting the system as disclosed by the patentee as a whole. In his Lordship's opinion it was beyond dispute that the system of wireless telegraphy disclosed by the patent was one of great merit, and so far as it concerned the utilisation of the principle of resonance and the consequent possibility of securing that selectivity which was indispensable for practical purposes, it constituted a great advance on Marconi's patent of 1896. It was equally certain, he said, that the patentee had been inadequately remunerated. Various causes had contributed to that result. It naturally required time and money to put such a system on a commercial scale. Further, at the date of the patent, a really satisfactory coherer had yet to be invented, and that was only done after experiments extending over several years. The owners of the patent had also been seriously embarassed by the Post Office monopoly, and he understood that they had not even yet been able to obtain a licence to work the system in this country. The case was one, therefore, in which the Court would naturally incline towards granting some extension of the patent, and no one appeared to oppose such extension. The Solicitor-General had, however, on behalf of the Crown, pointed out that all systems of wireless telegraphy at present in use, involved precise tuning, and such tuning was alone rendered possible by removing the coherer from the path of the receiving circuit, and that was usually effected by means of adjustable inductances. Further, in most cases means were employed for enabling the same instrument to be used either as a transmitter or receiver, and it was pointed out that the patentee had never taken any steps to prevent this being done. It was suggested, therefore, that any prolongation of the patent might seriously embarrass the development of wireless telegraphy in this country, more especially as the patentee had no corresponding patent in other countries, except in the United States of America. He (the learned Judge) thought those considerations could not be disregarded, and they were not entirely met by the petitioner's offer to grant a licence to anyone who desired to use the patent upon reasonable terms to be settled by the Board of Trade, or some expert appointed by the Board of Trade. The patentee, in his evidence, had laid great stress upon removing the coherer from the circuit of the receiver, and placing it in the derivative circuit, but he could not find that there was any separate claim directed to that portion of the system, though, no doubt, there was a separate claim for connecting the circuits of the receiver and coherer through a transformer to avoid metallic connection. He thought it probable that the omission was intentional, and was due to the experiments made by the patentee with syntonic Leyden jars, the result of which experiments was published in 1890, and referred to in the provisional specification. These experiments, it was true, appeared to have been operated by means of the lines of force in the magnetic field, and not by ether waves, but in his lecture before the Royal Institution, in 1894, the patentee showed the same experiments as illustrative of how the principle of resonance might be utilised in connection with ether waves. Except for the fact that if the circuits were opened out so as to become good radiating or absorbing circuits, there would be no train of waves upon which the principle could operate. If, however, there was a radiating circuit which would create, and an absorbing circuit which would accumulate the effect of a train of waves, the removal of the coherer from the path of the receiving circuit would not be necessary, as it was in the case of syntonic jars. He doubted, however, whether the adaptation of the device shown in the syntonic jar experiment to

the open radiating or absorbing circuits could be considered a great invention. With regard to tuning in the sense of varying the natural frequency of the circuit, it had long been well known that it could be done by varying either the induction or the capacity, or both the induction and capacity of the circuit. For tuning his syntonic jars the patentee had provided a means for varying the induction. Under those circumstances he (the learned Judge) did not think that tuning by means of induction coils switched in or out as was desired, or by means of adjustable induction coils, could in itself be considered a great invention. Again, he could not think that there was any great invention in bridging over the spark-gap of a transmitter so that it could be used as a receiver. It appeared to him that the essence and merit of the invention was in the patentee's conception of the compromise which enabled, for the first time, full use to be made of the principle of resonance. He came to the conclusion that it was open to him on the construction of the Act to extend a patent as to one or more of his claiming clauses without extending it as to all, and taking into consideration all the circumstances of the case, he thought justice would be satisfied if he ordered that, at the expiration of the existing patent, the patentee should be granted a new patent to be confined to claims 1, 2, 6, 7, 9, 10 and 11 of the existing patent, such patent to be for seven years. The grant, however, would contain a proviso or condition making it incumbent on the patentee to grant licences to all persons who should desire to use the protected invention, on such terms as a duly qualified arbitrator, to be appointed by the Board of Trade, should think fit and reasonable. He was prepared to make an order to that effect.

Counsel intimated that they did not desire to add anything, and the order was made accordingly.

BRITISH WESTINGHOUSE ELECTRIC CO., *v.* THE ELECTRICAL CO., LTD.

THIS action, which was commenced before Mr. Justice Swinfen Eady in the Chancery Division on Thursday, April 27th, related to an alleged infringement of patent in respect of arc lamps.

Mr. Walter, K.C., with Mr. J. Hunter Gray and Mr. E. Russell Clarke, were counsel for plaintiffs; and Mr. Bousfield, K.C., and Mr. Colefax were for the defence. Solicitors for plaintiffs, Messrs. Faithfull & Owen; for the defendants, Messrs. Michael Abrahams and Co.

In opening the case, MR. WALTER said the action was brought by plaintiffs for an alleged infringement of the letters patent of one Bremer, No. 18,786 of 1902. This patent had already been before the Courts, and its validity had been certified in the Court of Appeal. The patent related to an arc lamp of a kind suitable for burning flame arc carbons. The invention which plaintiffs alleged defendants had infringed related to the class of arc lamps in which the electrodes were inclined to each other and both pointed in a downward direction, the arc being formed at their lower extremities. One object of the invention was to provide an improved means for causing the points of the electrodes to approach and touch each other, and then separate for the purpose of striking an arc, such means being also applicable for causing an approach of the electrodes, where the arc by reason of the consumption of the electrodes became longer than its normal length. His invention applied to lamps of the type in which the current was supplied to the electrodes through electrode holders, in which the upper ends of the electrodes were firmly clipped, and which were capable of being lowered simultaneously through the same distance, and about one of which the corresponding electrode could swing under the action of a device acting near its lower end. That was the type of lamp which defendants had infringed in practically every particular, for their lamp with the exception of certain additions was identical with the Bremer patent. Mr. Walter then proceeded to describe the defendants' lamp in order to show the similarity and produced a model. He also read the judgments given in the Court of Appeal in other actions in which the validity of the plaintiffs' patent had been upheld.

The defendants denied any infringement, and declared that the original claims of the letters patent were not framed in good faith or with reasonable skill and knowledge. Further, they alleged prior user.

The first witness was MR. JAMES SWINBURNE. Witness said he was familiar with what had been done in the early days of arc lamps. As time went on the carbons used in arc lamps were very much improved, and a sudden change in their development took place when the impregnated carbons came into use. When they were first introduced they caused considerable trouble owing to the irregularity of their burning—in fact, prior to the introduction of the Bremer patent no successful flame arc lamp had been placed on the market. This invention applied to oblique carbon lamps, and the special point about them was that they had a downward feed mechanism, whilst, unlike the old form of carbon lamp, the carbons always moved in one direction. The end of one of the carbons moved in a horizontal direction, and the two movements were so connected that an excessive horizontal movement resulted in subsequent vertical movement, and there was no pull back on the carbon. Witness had examined the defendants' lamps, and the differences between it and plaintiffs' lamp were in the nature merely of additions, and were not alterations to the Bremer principle.

Cross-examined by MR. BOUSFIELD: At what date may we place the beginning of flame arc lighting?—In the early part of the last decade.

These flame arc lamp carbons were used commercially some time before the Bremer patent?—I do not remember any; they were looked upon as curiosities at first, but as they were improved they began to get a hold.

Continuing, WITNESS said that the irregular burning of carbons was a common problem in the early days, and it was common knowledge that the retractile strike action was the way to deal with the matter.

MR. BOUSFIELD: The cure which Mr. Bremer puts in his patent is the old cure known as the retractile strike which had been applied in the early days of electric lighting?—Yes.

WITNESS denied that before the Bremer specification there were half-a-dozen oblique carbon arc lamps in existence. There might have been another such device in existence, but he had no recollection of it.

I do not say there was a commercial pattern which you could buy over a counter, but inclined carbon lamps for the purpose of casting no shadow were well known?—I do not think they were.

Do you remember that there was an inclined carbon lamp in Leicester Square?—No, I absolutely do not remember any.

However, there would be no difficulty about making an inclined carbon lamp?—I think there must have been, otherwise I cannot make out why they did not come in before.

Given an inclined carbon lamp in which the carbons were fed down in the shape of a V, there would be no such difficulty in applying a retractile strike to such a lamp?—A little more difficulty than in a straight lamp, but not much.

The retractile strike is apt to describe the plaintiffs' arrangement as well as that of Serrin's lamp?—Yes.

As a common feature not only of Serrin's lamp, but of all I have seen, the striking mechanism is governed by one or more electromagnets?—Yes.

And it operates so that when the carbons are in contact by means of the solenoid or electromagnet, the points of the carbons are drawn asunder to strike the arc?—Quite so.

Then, in order to make that retractile, you must so arrange it that when the arc gets a little too long, instead of feeding straight away, you allow the striking movement which is at the point of contact to be reversed slightly, so as to move them a little nearer together?—Yes, before the feeding begins.

That is the retractile movement which we have in so many of these lamps?—That is so.

WITNESS said that the arc was struck by pulling the carbons apart, and the floating movement was in the same direction as the strike.

WITNESS said he could imagine an inclined carbon lamp in which the strike might be made longitudinally. He could not, however, recall such a case, except one, perhaps. It was true that in a large majority of cases where there were inclined carbons, one or both of the carbons were pivoted so that the strike was in a different direction from the feed.

Assuming that you have got a lamp with inclined carbons and horizontal strike, I gather that practically the only way of making that retractile is to have a retractile motion in the same direction as the strike?—No, it is the only way of making the strike retractile, but you can make the lamp retractile.

Continuing, WITNESS pointed out that the retractility was not necessarily combined with the striking.

Further cross-examined in regard to the arrangements for pivoting the electrode holder, WITNESS agreed that it was wrong in principle to so pivot the electrode holder that in burning up the carbon the range of movement of the lip of the carbon was doubled, while the range of movement of the armature was the same. But while wrong in principle it was not a fault which would prevent the lamp working.

Your attention has been called to the fact that for some two or three years the original Westinghouse lamps did not work successfully.

WITNESS said he had heard so, but did not know it of his own knowledge.

In the commercial Westinghouse lamp of to-day, the carbon does not pivot about the electrode holder does it?—I do not know.

At all events, in the defendants' lamp you know it does not pivot above the electrode holder?—No, the whole frame is pivoted so that the pivot remains in a constant position.

That is to say whether your electrode holder is at the top or whether it is at the bottom, for a given movement of the magnet you get a given movement of the lip of the electrode?—Yes, and from that point of view it is better, though, on the other hand, you have a bigger mass, and from that point of view it is worse, but on the whole it is better, certainly.

The less mass you have got to move the better. By making your magnets more powerful and better able to deal with the given mass you get the advantage on pivoting?—Yes, but that means more money. I quite agree it is a better arrangement.

Proceeding, counsel referred to the specification of Hedge's lamp, which he said was a lamp with carbons inclined downwards and pivoted, the arc being struck by electromagnets and so on.

WITNESS said that it was merely a paper document and would never work efficiently in practice.

You have got certain electromagnets which grip the carbons against the tube by reason of there being some magnetic substance in the core of the carbon, and you have an electromagnet which serves to strike the arc. Why, then, should it not work?

WITNESS replied that such a device would not work, because the carbons were held by two other electromagnets, and one was always released before the other. The result was that after burning a little while, one would release, and the carbon would pass under the nose of the other and drop out, because there was nothing to stop it.

In the same sense then, it is perfectly easy to see that the plaintiffs' specification will not work?

Witness replied that that was not so. It was a very common fallacy in the designing of arc lamps to make two such separate feeds, and the arrangement was really an impossible one.

In answer to further questions by Mr. Bousfield, Witness said that an oblique adjustment did not in itself cause a lamp to "pump," but it was liable to do so if the adjustment gave a long play. A dash pot was a known remedy for reducing pumping. He agreed that the plaintiffs' specification did not show how to get the spring arrangement and the magnet.

Mr. Bousfield: And in order to get the nice adjustment necessary in the plaintiffs' lamp you have to supply for common knowledge the requisite information as to how to balance a spring against a magnet in order to get the floating action?—Entirely so; but the plaintiff does show you the idea that you are to have what is called floating.

Witness denied that Bremer had no idea of adapting a lamp to burn irregular carbons; it was the whole idea of Bremer's specification.

In re-examination, Witness said there was nothing in the plaintiffs' specification, taking the figures and letterpress together, which hinder an electrician from carrying out the invention. What was wanted was to get the invention so described that the man carrying it out knew what to aim at, and that was secured in Bremer's specification. The drawings were faulty, but they were faults which would correct themselves. Plaintiffs' lamp was a very different type of lamp from that of Jamin's specification. With regard to Graham's invention, witness said that no one reading that specification would have been taught to make the plaintiffs' lamp.

Questioned in regard to other specifications, viz., Payel's, Crossby's, &c., Witness said they all differed materially from the plaintiffs'.

Mr. Edward Marshall, commercial manager of the Union Electric Co., of London, said his company were agents for Messrs. Körting & Mathiesen, the manufacturers of the "Excello" lamp. Witness's firm paid the patentees a royalty on the sale of this lamp, and up to the present time they had disposed of about 19,500 of them in this country. A considerable number had also been sold under the foreign patents.

Cross-examined by Mr. Colefax, Witness said the lamps were made in Germany, and his firm were the selling agents. His firm did not take any lamps from the British Westinghouse Co., nor had they done so within witness's recollection. He had been with the Union Electric Co. for about eight years. His firm had been selling a lamp similar to the "Excello" for the last six years. He could not say whether the type had remained identical throughout that period. Messrs. Körting & Mathiesen were the sole makers of this lamp, and he agreed that the British Westinghouse Co. made a lamp on very similar lines.

This concluded plaintiffs' case.

Mr. Bousfield, opening the case for the defence, said that, according to his learned friend, they were dealing with a specification which had to do with arc lamps, and the merits of which depended on their utility for flame arc lamps, whereas on the face of Bremer's specification he submitted that it had no more to do with flame arc lamps than it had to do with any other lamps which had been used for the past 30 years. Electric arc lamps with downwardly inclined carbons, one of which was pivoted for the purpose of striking horizontally, were a perfectly well-known type of lamp at the date of Bremer's specification. It had been clearly demonstrated and admitted that the difficulty which arose from the irregularity of the burning of carbons was one of the earliest defects in the early days of electric lighting. That defect had been remedied. It was also admitted that the defect introduced by the impregnated carbon was precisely the same difficulty which had existed with the older form of carbon, and the method of solving it was precisely the same. The one thing it was desirous should be obtained was the retractile action, but Bremer's specification did not say a word about it. All Bremer dealt with was the action of the gradually approximating carbons one to another as they burnt away. It was very doubtful whether Bremer ever had in his mind the problem of retractile movement at all. None the less, it was a very old problem and had been thoroughly dealt with on every scientific principle. The majority of lamps had been made with this retractile action before Bremer's specification, and unless it was present, it was impossible to burn anything but first-class carbons. That being so, there was no difficulty about anyone choosing to apply the principle to a type of lamp with downwardly pointing electrodes, one of which was pivoted. And it was on the ground that Bremer applied this old retractile strike principle to inclined-carbon lamps, which was also an old and solved problem, that the plaintiffs now claimed an injunction against defendants' lamp. There might well be invention providing the retractile strike to an inclined-carbon lamp, but its value and utility would depend on the way in which the two principles were applied and the way in which they would work together. In this respect, however, Bremer had taken no such trouble. He had flung at the world specifications accompanied by designs which were so faulty that they would not produce a workable lamp, but had declared "my invention lies in the introducing of the idea. There are many types of old lamps which will provide the mechanism, &c., by which my idea might be carried out." Surely, his Lordship would not hold that such a contention formed suitable subject matter for patent rights. As a matter of fact, it was in devising a mechanism for the successful application of the principle where the real ingenuity came in. Continuing, counsel pointed out that the mechanism for the simultaneous lowering of the carbons, which was the whole essence of the practical working of the lamp, was so shown in Bremer's specification as to be absolutely useless. He denied that the defendants had been guilty of any infringement, because he submitted that if the defendants' lamp differed by so much as one factor from that of plaintiffs', it was sufficient to avoid infringement. Continuing, he dwelt at great length on the minute details of the two lamps in question. The defendants' lamp was a far better lamp than that described in plaintiffs' specification, and yet the plaintiffs were declaring that if defendants wanted to burn impregnated carbons in their lamps, defendants were not entitled to use a principle which was common knowledge and apply the well-known principle of the retractile strike.

(To be continued.)

Kelvin & James White, Ltd., and Hutton *v.* Henry Hughes and Son, Ltd.

In the City of London Court on 2nd inst. plaintiffs sued defendants, who are marine opticians, of Fenchurch Street, E.C., for £18 4s., the balance of £164 for goods supplied.

According to the report in the *Financial Times*, Mr. Cecil Walsh, who appeared for the plaintiffs, said that Kelvin and James White, Ltd., and Mr. Hutton were in partnership in London, and Kelvin & James White, Ltd., carried on an entirely independent business in Glasgow. The London house had an English agency for Kelvin's compasses. Plaintiffs had supplied the defendants with goods to the amount of £164, and now demanded the balance due.

Mr. Simner, defendants' counsel, said that the defendants had an inquiry from Commander Faught, of the Turkish Navy, for some of Kelvin's compasses. Plaintiffs' Glasgow house promised to give defendants 5 per cent. commission, and as goods to the amount of £364 had been sold to Turkey, plaintiffs should deduct the defendants' commission.

Mr. Walsh said the plaintiffs had nothing to do with the Glasgow business.

Mr. Hutton, one of the plaintiffs, gave evidence that he and Kelvin & James White, Ltd., were in partnership in London. Kelvin and James White, Ltd., consisted of about 25 shareholders.

Mr. Simner said that being so, the plaintiffs were an illegal corporation, as no trading corporation of over 20 could trade with a separate individual unless they were all registered, and they were not. If Kelvin & James White, Ltd., could trade in partnership with Hutton, then any number of companies might combine and trade together. That would be a monstrous state of things. An illegal association could not recover debts. The absence of registration made it an illegal association.

Mr. Walsh did not know any objection to a limited company joining in a partnership. The plaintiffs' partnership was composed of two persons. The point was very important to companies and firms. A limited company had been held to be one person on many occasions. Sir Francis Palmer, the well-known company authority, in his book on "Precedents," included a clause providing for a limited liability company going into partnership with any other person or any other firm. Lord Justice Buckley had said in his book: "'Person' includes a body corporate. A limited company may become a shareholder in another company." Mr. Simner said that the plaintiffs were not a limited company. They were a partnership. The Court was opening the door to a very great evil.

Judge Rentoul said he would find for the plaintiffs, with costs, on the claim, as well as on the counterclaim. In his view Kelvin and James White, Ltd., combining in partnership with Mr. Hutton, was perfectly justifiable, although he had never heard of the point arising before. He gave the defendants leave to appeal. If they appealed they would pay costs on the higher scale because of the importance of the matter.

Frost *v.* Kotyra and Another.

In the Middlesex Sheriff's Court on Tuesday, Mr. T. Frost, an agent, of Hammersmith, was awarded £2,000 damages against Mr. Max Kotyra and the Count de St. Euilhem, for breach of contract. The matter related to the Kotyra telegraph transmitter and perforator. From 1904 plaintiff assisted the defendants in connection with the work preliminary to the formation of a company with £100,000 capital, and he devoted some years to the matter, but subsequently defendants, finding a wealthy partner, decided not to proceed with the formation of the company. They first offered £200, then £300, and later £600 for his services, and the jury now awarded £2,000, with costs.

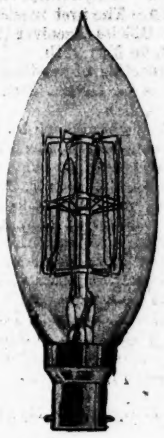
Motor-Car Lighting.—Messrs. C. A. Vandervell and Co., of Warple Way, Acton Vale, W., have asked the Royal Automobile Club for a severe test of their self-contained electric lighting system, including a practical road trial of 4,000 miles under R.A.C. observation and additional tests on the Brooklands track, together with tests, &c., of the dynamo and lamps. Over 1,000 of their lighting sets, they say, have now been installed in motor-cars.

Fatality.—On Monday afternoon at Peakdale, a Rochdale man, named Hamlet Tattersall, was working at the asphalt works which have recently been taken over by a Rochdale firm, when he accidentally came into contact with a live wire, and was killed on the spot. Deceased leaves a widow and 13 children.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Tantalum Candle Lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, N.E., inform us that they are now placing upon the market a further range of tantalum candle lamps. Hitherto these lamps have not been supplied in higher voltages than 60, in 5 and 10 candle-power sizes, but the new types will be supplied in



Tantalum Candle Lamp.

10 and 16 candle-powers for 70 to 120-volt circuits. The filaments will be of drawn tantalum, and the efficiency will be the same as that of the ordinary tantalum lamps at present on the market. It is anticipated that these lamps will be in large demand for series burning in candelabra fittings on high-voltage circuits; they are approximately 5 in. long and $1\frac{7}{8}$ in. in diameter.

New Fault-Localiser.

In the note on this new device in our last issue, Mr. R. W. Paul's address was given as Hatton Garden; we are, informed, however, that his address is now Newton Avenue Works, New Southgate, London, N.

BUSINESS NOTES.

Condensing Plants.—The following orders have been recently received by the Mirrlees Watson Co., Ltd. for steam condensing plant:—

Surface Type.—One set for the Compania De Gas y Electricidad, Habana; one set for Messrs. Mechan & Sons, per Mr. P. J. Mitchell, London; two sets for Malta Dockyard, per the British Thomson-Houston Co., Ltd.; one set for Regina, per the Canadian Boving Co., Ltd., Toronto; two sets for Stoke-on-Trent Electricity Works, per Messrs. Jas. Howden & Co., Ltd.

Counter Current Jet Plants.—Two sets for the Golden Rock Sugar Factory, St. Kitts; one set for Formosa; one set for Messrs. A. Kenneth & Sons, Dreghorn, per Messrs. C. A. Parsons & Co.; one set for Usina, Mussurepe, Pernambuco; one set for San Domingo. Also for extension plant for Barrow Colliery, per Mr. P. J. Mitchell, and for the Usine de Tuilière, Bordeaux, per the Compagnie Française pour l'exploitation des procédés Thomson-Houston.

Enclosed Fuses.—The advantages of the "Zed" type of fuse, introduced by Messrs. Siemens Brothers Dynamo Works, Ltd., has been recognised by Mr. S. W. Baynes, electrical engineer to the St. Pancras Borough Council, who recently, in explanation of his rule that "main fuses should be of the enclosed cartridge type, built up of porcelain," stated in the *Electrical Contractor* that if the fuses were protected in a similar manner to the "Zed" fuses, with porcelain, and no charged metal parts were exposed, he did not intend requiring any further protection—that is, a teak box lined with asbestos would not be asked for. As we have previously remarked, fuses in this country are in a backward stage of development, and the "Zed" type of fuse, in which all live parts are completely enclosed, and the fusible portion is contained in a sealed chamber, represents an important step in the direction of safety from fire risk.

Bankruptcy Proceedings.—W. H. Illingworth, electrical engineer and dealer in electrical lamps and fittings, Halifax.—Receiving order made April 27th at Halifax, on debtor's own petition. First meeting May 10th, public examination May 19th, both at Halifax.

For Sale.—The Newport Corporation Electricity Department has for disposal a quantity of scrap metal, &c. See our advertisement pages in this issue.

Catalogues and Lists.—Messrs. British Insulated and Helsby Cables, Ltd., Prescot, Lancs.—Twenty-page excellently illustrated list (P. 114), containing a full description of their Prescot spot welder, and their electrical seam welder, and the work that they do, also particulars of prices, weights and dimensions.

Mr. Chas. E. Miller, 97-103, Reade Street, New York.—Catalogue of over 250 pages of illustrated and priced particulars of automobile supplies of all kinds.

Messrs. Sulzer Bros., 30, Norfolk Street, Strand, W.C.—Illustrated circular showing by means of tiny photographs, and also on a map, the installations of Sulzer-Diesel engines that they have supplied in different parts of the world.

Messrs. Haes & Eggers, Ltd., electrical and mechanical engineers, &c., of 163, Clarence Street, Sydney, have sent us a useful desk writing pad with diary. The latter is spacious, and especially noteworthy is its position—namely, on the *right*-hand side of the pad, where it is less likely to get underneath an accumulation of papers.

Messrs. Walter Newbold & Co., 10, Arthur Street West, London Bridge, E.C.—New list (M4), giving illustrated descriptions and prices of a variety of saw-benches and sawing and other wood-working machinery.

The London Electric Wire Co. and Smiths, Ltd., of Playhouse Yard, Golden Lane, E.C., April, 1911.—Revised price list of rubber cables (Association, non-Association, shot-firing and fittings, dynamo and motor, telephone, aerial and lift), flexibles for various purposes, instrument, telephone, and high-resistance wire, also cotton, sleevings, dynamo brushes, jointing materials, ebonite and insulating varnishes. A number of useful tables of H.C. copper wire, annealed and silk and cotton-covered, fuse wire, aluminium wire, and standard wire gauges for copper conductors, are also contained in this 56-page book.

Messrs. Adams Manufacturing Co., Ltd., 106, New Bond Street, W.—16-page brochure concerning their metallic dimmers dealing with the case of the metallic *v.* the liquid dimmer. Copies will be sent to anyone interested on application.

The "Aurora" Steel and Iron Gearing Co., Rodley Lane, Sheffield.—Pamphlet illustrating a number of their manufactures, including helical spur and bevel gears, reduction gears from ½ to 500 H.P., spur wheels with winding drum and eccentric worm gear, raw hide gears, &c.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Abridged Catalogue (No. 170) containing revised prices announced at the end of February, and cancelling all earlier copies of general lists. The publication contains 76 pages of illustrated matter relating to a wide range of telephonic apparatus for various classes of service, and many incidental lines, closing with a telegraphic code.

Messrs. Allen, West & Co., Ltd., Lewes Road, Brighton.—New catalogue containing well-illustrated descriptions with dimension sketches, and fully tabulated prices, &c., of their porcelain handle fuses, their new line of drum type controllers, stamped resistance grids, and heavy service controllers for steel works, collieries, &c.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Birmingham.—Pamphlet (M 276) containing an illustrated description of their Vickers E.O.A. control pillar for starting and shunt control of D.C. motors.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New edition of "Engineering Supplies" catalogue (Section "E" twelfth edition) containing 32 pages of illustrated information, with prices clearly shown, concerning their small power motors, portable electric tools, grinding and polishing machines, rotary pumps, electric sweepers, vacuum cleaners, the electric "Mary Ann," accumulators, dynamo and engine accessories, traction material, &c. Also a 24-page catalogue of "mixed plant" (Section "P" twelfth edition) wherein neat half-tone illustrations appear together with descriptive, price, weight, output and other matter, of the following:—Steam dynamo sets, turbo-generators, oil engines, gas engine sets, suction gas plants, complete house plants, wind turbines, water wheels, boilers, pumps, hoists, lifts, lifting magnets, &c. The object of this list is to enable estimates for the usual electric lighting plants to be made out by engineers and others on the spot.

Messrs. D. H. Bonnella & Son, Ltd., 58-60, Mortimer Street, London, W.—List of light accessories (No. 353) giving prices and illustrations of a number of adaptors for two-pin wall plugs, flexible cord connectors, china connectors, &c.

Belgium.—A plant for the manufacture of armoured electric cables has recently been established at the works of the Société des Ateliers des Constructions Electriques, at Charleroi. Hitherto all such cables for use in Belgium have had to be imported.

Ozonised Air in a Tube Railway.—We are informed that an important contract has been placed with Messrs. Ozonair, Ltd., for the ventilation of the Central London Railway on their patent system; at each station air-cleaning plant is to be installed, capable of supplying the adjoining section of the tube with eight million cubic feet of purified air per day. The air is to be drawn through a filter to remove impurities, and sterilised by means of ozone, a slight excess of which will be allowed to pass into the tunnel. The experiment will be followed with keen interest, as it promises to put an end to a source of discomfort which acts as a strong deterrent to many would-be passengers.

The General Electric Co. in China.—In connection with our recent articles on the opportunity that is now presented to British electrical firms in China, our readers should be interested in important developments that have been set on foot by the General Electric Co., Ltd. A few weeks ago we recorded the registration of the General Electric Co. (of China), Ltd., and we learn that the feeling existing among the founders of this company is very similar to those expressed in our recent remarks regarding the present Chinese awakening and its certainty to promote a considerable demand for electric lighting and other plant and apparatus. The G.E.C. have felt for some time past that trading through agents would not give them that hold upon the Chinese market which they are desirous of obtaining. They have, in consequence, formed the above new company with £21,000 capital, which, for the present, should be capable of handling their ordinary supply business; whilst for large engineering contracts, we gather that the parent concern is willing to finance any big scheme that may be offered to what is virtually its branch out in China. The whole of the shares in this new venture are held by the G.E.C., with the exception of a few that have been given to, and reserved for, members of the staff. The management of the China company has been placed in the hands of Mr. Percival H. Nye, an old G.E.C. man, who recently returned to England after five years' residence in Hong Kong. He departed again last week, for the purpose of organising the various branches that are to be established. Mr. Walton, who received his training in engineering practice at the Witton works of the company, accompanies Mr. Nye as engineering representative, whilst others to leave for the Far East on the new undertaking are Mr. Gilbert (another old G.E.C. man), who has principally been associated during recent years with the arc lamp and supply departments, and Mr. Schwabacher, who combines both engineering and counting house experience, having passed through the works at Witton, and also through the counting house at the head office of the company. This staff will settle with its head office at Shanghai, and will proceed to open branches in Hong Kong, Tientsin and various other parts of China. Large stock of all G.E.C. manufactures will be kept out there, and trading will be carried on upon the same system that the G.E.C. adopt for their own business in this country. It is only consistent with our well-known trade policy that the ELECTRICAL REVIEW should wish every success to this new enterprise. We are authorised to state that consequent upon our recent article, the G.E.C. (of China) is willing to accept agencies for such electrical manufactures as are not in competition with the manufactures of the parent G.E.C.

Bankruptcies in the Electrical Trades.—During the three months ending with March last there were only six receiving orders in bankruptcy issued against electricians and electrical engineers in England and Wales, as against nine in the first quarter of 1910.

Australian Association of British Manufacturers.—According to the *Australian Mining Standard*, a general meeting of the Australian Association of British Manufacturers and their representatives was held at the Commercial Travellers' Club, Melbourne, on March 7th. The business was the election of officers. Mr. James Wilson (India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.,) took the chair. The following gentlemen were elected as members of the Executive Council:—President, Mr. Percy Rosling (W. T. Henley's Telegraph Works Co., Ltd.); Vice-Presidents, Messrs. Benj. K. Morton, Geo. Shrimpton, Edwin Wood; Councillors, Messrs. Geo. M. Buchanan, Geo. Smith Morrison (Siemens Bros. Dynamo Works Ltd.), Irwin Hinds (Gibson, Battle & Co., Ltd.).

The Building Trades' Exhibition.—The Building Trades' Exhibition at Olympia, which closes to-morrow, May 6th, is certainly a very fine and representative show of most things that interest the building trades, but it is not particularly strong in respect to the electrical parts of the equipment of the up-to-date residence or business building. There are a couple of electric lift exhibits, and two or three fittings displays. We referred last week to the admirable collection of choice electric light fittings shown by Messrs. Osler. Other firms displaying manufactures of this description are Messrs. Strode & Co., and Messrs. Thursfield. Messrs. A. Emanuel & Sons, Ltd., likewise are in evidence with a variety of electric light fittings, while they are making an equally prominent feature of a line of devices, including the "Kwik-fix" ceiling rose, switches, cut-outs, fuseboards and so forth. The Adams, Watkin Co., Ltd., have a well-arranged stand where they show the convenience and control of their switch applied to all kinds of domestic appliances. In a specially fitted-up showroom the application of the switch to "Linolite" and to candle fittings is effectively displayed. The company are now making these switches in larger sizes. One of large size (6,000 watts) has just been made for controlling all the lights in Westminster Abbey, so as to get the "dim religious light" required at certain stages of the Coronation service. Among other exhibits the following are observed:—Mr. W. Boby, water softeners; Rawdon Foundry Co., Ltd., motor-driven pug-mill and mixer, and sanitary pipe-making machines; Horsfall Destructor Co., Ltd., and Heenan & Froude, Ltd., dust destructors; Messrs. Pinchin, Johnson & Co., an effective stand devoted to their "Minerva" and other paints, the upper portion of which is outlined with electric lamps; Reavell & Co., Ltd., compressors, also oil engines for country house electric lighting plants; Messrs. Wilkinson, Heywood & Clark, Ltd., paints; Messrs. Tuke & Bell, Ltd., electric light fittings, telephone installation, and electric wind recorders.

Church Lighting.—We have received from MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, reproductions of a couple of untouched photographs showing the interior of a church illuminated by incandescent gas and electricity respectively. The "Onewatt" lamp was introduced in place of the superseded mantle, and the details of the interior of the building are brought out admirably in the electrical photograph, while our natural reticence compels us to refrain from an account of the disadvantageous features of the gas specimen. Unfortunately, the pictures do not lend themselves to reproduction in our pages, but we understand that the original photographs, which have not been touched in any way, may be seen at the firm's offices by any reader who is sufficiently interested to desire to make an inspection. We learn that not only is there a better illumination and a reduced lighting bill, as compared with gas, but it is also anticipated that money will be saved owing to lower bills for re-decoration and cleaning of the church.

Dissolutions and Liquidations.—THE BRITISH TUNGSTEN LAMP CO., LTD.—The first meeting of creditors will be held at the offices of the Official Receiver (Mr. E. D. Symond), 35, Victoria Street, Liverpool, on May 12th.

ARC LAMPS, LTD.—A meeting of creditors is to be held on Tuesday, May 9th, at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C.

RHONDDA TRAMWAYS CONSTRUCTION SYNDICATE, LTD.—A meeting of creditors is to be held at Queen Anne's Chambers, S.W., on May 8th. Creditors must send particulars of debts, &c., to the liquidators, Messrs. Schlesinger & Cownie, by that date.

R. H. PATTERSON & CO., iron and machinery merchants, Newcastle-on-Tyne.—The partnership of Messrs. R. H. Patterson and J. F. A. Cookson has been dissolved. Mr. Patterson attends to debts, and will continue the business under the old style at Forth Street. Mr. Cookson will continue business in his own name at the old address, 2, St. Nicholas' Buildings.

NORTH-WESTERN ELECTRICITY AND POWER GAS SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. C. E. Bullock, Albion Street, Hanley, as liquidator. Creditors should send in the usual particulars by May 30th.

ELECTRIC FOG SIGNAL CO., LTD.—This company is winding up voluntarily, with Mr. A. T. Spear, 44, Myddleton Road, Uxbridge, as liquidator.

Trade Announcements.—MESSRS. THOS. KESNOR AND CO., LTD., have transferred their business from Fulham, to new premises at Whippendell Road, Watford, Herts. Telephone, No. 180 Watford; telegraphic address, "Kesnor, Watford."

THE INDESTRUCTIBLE CABLE CO. have removed to 20, High Holborn, W.C.

MESSRS. VICKERS, SONS & MAXIM, LTD., announce that the name of the company has been changed to Vickers, Ltd.

THE ST. HELENS CABLE AND RUBBER CO., LTD., of Warrington, have removed their Newcastle office and stores to 8, Charlotte Square, Cross Street, Newcastle-on-Tyne.

MESSRS. RODGERS BROS. have acquired, as a going concern, the gear manufacturing business of Messrs. J. B. Hamilton & Co., Ltd., late of Unica Works, Southey Road, Tottenham, which they have added to their own business of gear specialists and general engineers. They have recently erected an entirely new and modern works at Baker Street, Brixton, London, S.W., where they have added a new battery of modern gear-cutting machines. Messrs. Rodgers have appointed Mr. P. F. Brittain, who was associated with J. B. Hamilton & Co., Ltd., as sole agent for the sale of their gears, with offices at 110, Cannon Street, London, E.C.

We are requested to state that the RADIUM ELECTRIC CO., 82, Hatton Garden, E.C., is not, and never was, connected with a company of the name of Radium Lamps, Ltd.

Diesel Engines.—In addition to the list of orders published in February, totalling between 3,000 and 4,000 H.P., the DIESEL ENGINE CO., LTD., have recently received the following orders:—

Letchworth Garden City (repeat order), one engine of 420 B.H.P.; Leek U.D.C., one engine of 330 B.H.P.; Reigate U.D.C., two engines of 150 B.H.P each; for the Chilian Government (per General Electric Co.) two engines of 270 B.H.P. each, and two of 200 B.H.P. each; Messrs. Balfour Williamson & Co. (for Chile), one engine of 320 B.H.P.; Chichester Electricity Supply Co. (per Messrs. Johnson & Phillips), first extension, one engine of 200 B.H.P.; Great Northern Railway, one engine of 340 B.H.P.; Messrs. Dick, Kerr & Co., Ltd., one engine of 525 B.H.P., one of 225 B.H.P., and two of 60 B.H.P. each; the Pacific Phosphates Co. (repeat order), one engine of 150 B.H.P. and two of 120 B.H.P. each; the Leatherhead and District Electricity Supply Co. (repeat order), one engine of 60 B.H.P.; and a number of others, including orders for India, Ceylon, Brazil, Shanghai, New South Wales, &c.

Coronation Illuminations.—THE CHARING CROSS, WEST END AND CITY ELECTRICITY SUPPLY CO., LTD., announce in our advertisement pages that they will send to installers of Coronation lighting, likely to be working for their consumers, Coronation application forms, giving particulars of charges for current and a map of the company's area of supply. They also desire to receive particulars of Coronation devices and charges for installing.

MESSRS. HARROD'S STORES have issued an interesting brochure beautifully illustrated in all the colours of the Coronation, flags, bannerettes, shields, garlands, and other general requirements suitable to the occasion. Some pages are devoted to electric signs, wreaths, festoons, "Pixielite" strip, and so forth.

THE IMPERIAL LIGHTING CO., of 157, Blackfriars Road, London, S.E., have just issued a catalogue of their "Fairyland" system for Coronation electrical illuminations. The plain "Fairyland" strip with bayonet holders, watertight holders, patent reflectors and lanterns, floral strip, letters, stars, crowns, flambeaux, trophies and other devices, are illustrated and priced. A number of photographic views show instances where the "Fairyland" system has been employed on important public occasions.

MESSRS. DUNCAN WATSON & CO., 62, Berners Street, Oxford Street, W., have issued a card giving prices of their flexible strip devices, and other supplies for Coronation electrical illuminations.

LIGHTING and POWER NOTES.

Accrington.—The Board of Trade has issued a provisional order for inclusion in a Confirmation Bill about to be introduced into Parliament, authorising the Corporation to supply electrical energy for public and private purposes within the urban district of Clayton-le-Moors and the parish of Altham.

Ashford (Kent).—The E.L. order sought by the East Kent Electric Supply Co., Ltd., for the urban area has been granted by the B. of T. The order also applies to the growing parishes of Kennington and Willesborough, in the area of the East Ashford R.D.C.

Bath.—At the last meeting of the Electric Lighting Committee of the T.C. an important scheme was brought forward with reference to the generating plant at the electricity works. It is proposed to install an 800-H.P. Diesel engine and 450-KW. dynamo at a cost of £7,500, and by this means it is anticipated that an annual net saving of £1,558 will result, so that the expenditure will be paid off in five years. A careful estimate as to cost has been made. The actual cost of generation with steam plant only for the year ending March 31st, 1910, was £5,625. The cost with combined Diesel and steam plant is estimated as follows:—1,000,000 units equal 300 tons of oil fuel at 42s. per ton, £630; coal for balance of winter load, 752,420 units, £1,136; oil, water and stores, £111; wages, £1,100; repairs and maintenance—buildings, £111; ditto plant, £309. Estimated total cost of generating 1,752,420 units with combined plant, £3,397. There is thus an estimated gross saving of £2,228, as compared with the figures of the steam plant only. From this have to be deducted capital charges on additional capital expenditure (£670), leaving a net saving of £1,558 a year. The Works Committee says that having regard to the serious loss of revenue occasioned by the introduction of metal-filament lamps, its attention has for some time been directed to the possibility of meeting this by effecting still further economies in generating, as this seems to be the only possible means of preventing an annual deficit. The Committee is to obtain authority from the Council to borrow the sum of £7,500 for this plant.

Bedford.—The T.C. has arranged the following charges for Coronation illuminations:—One day only, 2s. for the first 25 lamps (30-watt) connected; afterwards 1s. for each 25 lamps or under. Each additional day, 1s. per 25 lamps or under, a discount of 2d. in the 1s. to be allowed for prompt payment. Special arrangements will be made with non-consumers.

Blackburn.—The Corporation proposes to apply to the L.G.B. for sanction to borrow £45,170 for the purpose of extensions to the Corporation electricity works. The Electricity Committee recommends a reduced scale of charges for energy for power purposes to large consumers.

The electricity department made a profit of £697 3s. compared with £1,387 in the previous year. The total expenditure was £19,323, and included generation of electricity £8,253; repairs and maintenance, £4,790; lamps, fittings and motors, £2,295; rates and taxes, £2,151; management expenses, £1,684; and sundries, £148. From the sale of energy £35,017 was received; sundry rentals, £1,606; sale of lamps, fittings, &c., £1,748; leaving £19,048 to pay interest on loans, &c.

Brighton.—The Pavilion Committee of the T.C. has decided to have the electric wiring installation in the Dome thoroughly examined and brought up to date where necessary, at an estimated cost of £100.

For Coronation illuminations energy will be supplied during the four weeks from June 17th to July 8th, through a separate meter, at a flat rate of 1d. per unit, plus 5s. for connecting.

Burnley.—A L.G.B. inquiry has been held into the application of the Corporation for sanction to borrow £9,023 for the extension of plant at the electricity generating station and other purposes. The town clerk said the total capacity of the present station was 2,640 KW.; the maximum load up to date for traction purposes was 1,250 KW., and for lighting 900 KW., or a total load of 2,135 KW., leaving a reserve of only 490 KW. This the electrical engineer considered inadequate to meet any breakdowns. In order to install the proposed 1,500-KW. turbine plant, it would be necessary to displace old plant, the amount owing on which was £851, and this plant they proposed to sell.

Chadderton.—The Oldham T.C. has decided to proceed with the extension of the mains to Chadderton, and to apply to the L.G.B. for permission to supply additional consumers in the district.

Chichester.—The B. of T. has granted a provisional order for electric supply to the E.L. and Power Co., Ltd., enabling it to supply in the Rural Districts of Westhampnett and Westbourne.

Continental Notes.—TURKEY.—At the beginning of the present year the Société Imperiale Ottomane de Tramways et d'Eclairage Électrique de Damas was supplying current to approximately 11,650 lamps—exclusive of the public lighting—this being an increase of 2,650 lamps on the 12 months. In view of the growing demand for electricity, the plant at the sub-station in Damas is being extended, while a proposal to enlarge the plant at the El Tequieh water-power generating station is also under consideration.

GERMANY.—It is reported that a Swiss company is in negotiation for the establishment of a central electric lighting station in the town of Ingweiler.

ITALY.—The distributing mains of the Societa Bolognese di Elettricita, of Bologna, are being connected-up by means of overhead high-pressure cables to the water-power station of the Societa di Brasimone, with which concern a contract for a cheap supply of electrical energy has been entered into. When the work is completed, the existing plant of the Bologna company will be kept as a reserve in case of emergency.

Darwen.—The annual municipal returns show a profit of £353 on the electricity works for last year compared with £573 in 1910; £627 in 1909; £104 in 1908; and £65 in 1907. The decreased profit may be attributed to reductions in the price of energy to the tramways, and in the price charged for electricity for motive power.

Eccles.—An inquiry was held by Mr. Meade King, on behalf of the L.G.B., on Friday, April 28th, relative to the Council's application for sanction to borrow £3,783 for extension of plant at the borough electricity works, Patricroft. There was no opposition.

The electrical engineer has visited certain stations at which Messrs. Howden have supplied steam engines similar to those to be installed at the electricity works, and reports satisfactorily. He has been instructed to light streets in the vicinity of Milton Street with electricity at an estimated cost of £666.

Edinburgh.—The proposal that the surplus of £7,300 from the 1909-10 accounts of the electricity department should be applied towards the relief of rates was defeated at a meeting of the Corporation Electric Lighting Committee last week by 8 votes to 2. The Committee, it may be recalled, in September last recommended that the surplus be applied towards the reduction of the capital borrowed for electricity purposes, but the matter was delayed for further consideration. The Committee now adheres to its former recommendation.

Frinton-on-Sea.—The Frinton and District Electric Light and Power Co., Ltd., announce that from the June quarter the price of energy will be increased from 6d. to 7d. per unit, and the rent of meters will be reduced from 12s. to 10s. per annum.

Japan.—According to the last Japanese mail, there is just now considerable discussion taking place over a proposal of the Government to grant a concession to a third undertaking to supply electrical energy for lighting and power purposes. The Japan Electrical Association, considering that such action would be a serious blow to the electrical business, "as tending to impede its progress and development, and consequently calculated to disturb the general economic conditions," has petitioned the Government to reconsider the matter. The Aldermen's Council of Tokio has also submitted a memorial to the Minister of Home Affairs and Communications in which it is stated that, "Inasmuch as the granting of such a charter has an important bearing on the municipal undertakings, the Council hereby expresses a desire that the municipality should be consulted on the granting of a charter of this description."

Kirkheaton.—The question of substituting electric lighting for the present street gas lamps is to be fully considered at a meeting of the U.D.C.

Leicester.—The T.C. having made application to the L.G.B. for sanction to borrow £17,000 for purposes of the electricity undertaking, Mr. H. R. Hooper, an Inspector, held an inquiry on Tuesday into the matter.

Litherland.—The B. of T. has revoked the 1905 E.L. order.

London.—FULHAM.—Application is to be made to the L.C.C. for sanction to borrow £9,500 to cover capital expenditure in connection with the electricity undertaking during the ensuing 12 months, as follows: Extensions to generating plant, £5,950; alterations to generating station, £550; house connections, £1,000; electricity meters, £2,000. £100 is to be spent in illuminating and decorating the Town Hall building on the occasion of the Coronation.

SOUTHWARK.—In March, 1910, the Council decided to offer no objection to a proposal from the County of London Electric Supply Co., Ltd., to lay mains from its sub-station in Vine Yard, also Marshalsea Road, across London Bridge, in order to connect up its undertakings in North and South London. Owing to the disapproval by the City Corporation of the proposed mains within the City area, the work has not yet been put in hand. The company, however, has informed the B.C. that the plans have now been approved, and the route will be identical with that previously submitted.

The Electricity Committee has approved of a schedule of charges compiled by the electrical engineer, applicable to all the different classes and conditions of consumption, and bringing them into agreement with one or other of the headings in the specified scale.

SHOREDITCH.—The Lighting Committee reports having been in communication with the Great Northern and City Railway Co. with reference to an interchangeable supply of electricity. An

experimental supply has been in operation for some months to ascertain how far it is possible to secure economies by taking a supply of electricity from the railway company, at the time of heavy load, &c. The increased demand on the plant makes this a matter of considerable importance, and the Committee has settled the terms of an agreement under which the Council will take, and the railway company will give, a supply of electricity for temporary purposes of not less than 500 KW. for one year from April 1st, 1911, at a satisfactory price. The Committee further reports having had under consideration for some time other measures with regard to the rapidly increasing demand both for power and lighting. The additional applications received during the last 12 months amounted to over 1,100 KW., and the maximum load on the station is 700 KW. more than it was last year. As other supplies are in prospect which will further increase the load of the plant, the Committee considers it absolutely necessary to enlarge the present station or procure (in addition to the bulk supply from the Great Northern and City Railway Co.) a supply elsewhere, or both. The Committee is to be authorised to make inquiries, to obtain advice, and report fully on this matter.

BERMONDSEY.—The B.C. is in receipt of a letter from the B. of T. stating that after carefully considering all the circumstances of the case, it does not see its way to grant the prov. order for the St. Olave district asked for by the Council.

POPLAR.—The rate for lighting business premises of shopkeepers is to be reduced to £8 per KW. installed and ½d. per unit for all current consumed.

MARYLEBONE.—The Electric Supply Committee, in submitting its estimates for the year to end March 31st, 1912, states that the sales during the past year show an increase of 10 per cent. over the previous year. In estimating for the new year, it is allowing for an increase in the sales of 7 per cent. only, giving a total estimated sale of 11,820,000 to private consumers. During the current year the average price will amount to about 3·38d. per unit; a similar rate for the new year is assumed as to 11,050,000 units and an average of 1d. per unit only for the amount of the additional sales allowed for, thus giving an all-round average of 3·23d. per unit. As the public lighting scheme has now been practically completed, the income and expenditure can be estimated closely. With regard to rents, rates and sundries, the figures have been revised in view of the new assessment on the undertaking, which involves an extra burden of £8,500 per annum. In addition a substantial amount had been allowed for income-tax assessment. The total liabilities for rents, rates, taxes, insurance, law, audit, &c., expenses are estimated at £14,400, an increase of nearly £9,000 on the present year, and averaging ·260d. per unit on the larger output, against ·107d., the cost during the present year. In regard to the sales and publicity department, the Committee felt it could not be pointed out too emphatically that this department exists to increase the sale of current and not for the purpose of earning a profit on the sale of apparatus or the carrying out of works for consumers; the turnover for sales of apparatus, &c., during the year would amount to £16,000, and the gross profit thereon will be such that it will meet the whole of the general business-getting and business-keeping expenses except £1,825. After reducing the capital debt by £40,274, a surplus of £1,018 was anticipated on the year's working. The smallness of the anticipated surplus is due to the exceedingly heavy additional charge arising from the new assessment.

Longford.—The Coventry T.C. has offered to extend the mains to the parish on a guarantee that £200 worth of current will be taken per annum for five years. The cost of cable laying will be £2,000. Half the necessary guarantee has already been obtained.

Loughborough.—At Monday's meeting of the T.C., Alderman Bumpus, in moving the adoption of the electricity undertaking's balance-sheet, said the gross profit on revenue account was £1,874, an increase on the previous year of £1,020, which was a very substantial and satisfactory advance in the financial position of the undertaking. The increase in the output for power amounted to 50 per cent., and that for lighting to from 12 to 15 per cent. Parallel with that the cost of producing current had gone down The loss on the year was £330, against which there was a grant from the general district rate of £1,500 towards the loss on the year's work and the deficit which had accumulated. The whole of that £1,500 went to the previous deficit, minus £330 deficit of the year.

Maidstone.—The T.C. has decided that as from April 1st the charge for current for lighting shops and business premises shall be as follows: A fixed charge of 8s. per annum for each 32-watt lamp, or its equivalent, and 1d. per unit for current, or alternatively, the maximum demand system of 7d. per unit for the first hour per day, and 2d. beyond.

The T.C. has received the sanction of the L.G.B. to a loan of £4,000 for mains extensions for three years.

Pinner.—The Hendon R.D.C. has decided to assent to the application of the Harrow E.L. and Power Co. for a prov. order for electric light at Pinner. The R.D.C. had objected to the maximum price of 7d. per unit, and desired a special price for power and a purchase clause, but the B. of T. has intimated that a purchase clause is not desirable in a case in which the undertaking relates only to a portion of the district, and that the maximum price for lighting is usually fixed at 8d. per unit. With the consent of the Council, the B. of T. will now grant the order.

Portishead.—The B. of T. has granted a prov. order for E.L. to Messrs. Christy Bros. & Co., Ltd., of Chelmsford. The area of supply is the urban district and the parishes of Portbury, Easton-in-Gordano, North Weston, Abbotsleigh, Clapton Wraxall, Flax Bourton, Long Ashton, Nailsea, Tickenham, Weston-in-Gordano, and Walton-in-Gordano.

Southborough.—With reference to the supply of current to premises in the area of the U.D.C. by the Tunbridge Wells T.C., the U.D.C. has been recommended to give the necessary sanction, "subject to a communication to be received from the B. of T." This recommendation was discussed *in camera* at the April meeting of the Council. It will be remembered that the U.D.C. demanded a royalty on the current supplied, and that the B. of T. objected to this.

South Wales.—The South Wales Electrical Power Distribution Co. has applied to the B. of T. for consent to use overhead lines for the transmission of energy at a pressure of 11,000 volts from Maesycwmmer to Fleur-de-Lis, and from Bargoed to Groesfaen Colliery.

Stoke-on-Trent.—A motion to rescind the resolution empowering the Electricity Committee to obtain and accept tenders for the necessary buildings, plant and mains to carry out the £60,000 scheme for extending and linking up the four electricity works, was discussed at considerable length at last week's meeting of the T.C. The proposer was Alderman Geen, the deputy-mayor and chairman of the Finance Committee. He said the liability of the borough in respect of money borrowed was of a very alarming character, the total liability on the Corporation account being £982,746. The total liability on their gasworks would be £287,435, and, if the scheme was sanctioned, there would be an indebtedness of £219,992 in respect of the electricity undertakings. This indebtedness might be increased by another million if the Corporation carried out the policy, on which they had already decided, of purchasing the waterworks undertaking. Ald. Geen said that in 1917 they would have to decide whether they would take over the tramway system. He thought there was no reason why they should not purchase energy in bulk from the tramway company, retaining the distribution of the current. The Mayor, who supported, emphasised the fact that by the Federation Act the Corporation cannot make any profit from its electricity supply, and therefore the only question was, "Can we cover expenditure or shall we make a loss?" Eventually the motion to rescind was defeated by 56 votes to 35. For two induction motors in connection with the new power station which is to adjoin the Hanley works, the tender of Messrs. Siemens, of Stafford, at £2,385, has been accepted.

Tunbridge Wells.—The Education Committee of the T.C. has decided to have a report prepared with reference to the lighting of the public schools in the borough by electricity.

Warmley.—The B. of T. has revoked the 1903 E.L. order.

West Bromwich.—The sales of electricity during the financial year ending March 31st have been returned as follows:—Private lighting, £3,642, a decrease of £20; public lighting, £690, the same as last year; tramway traction power, £4,756, a decrease of £560; and motive power, £5,103, an increase of £1,660. The total sales amounted to £14,192, compared with £13,112, an increase of £1,080.

Worcester.—At a meeting of the City Council on Tuesday, it was resolved to adopt a recommendation of the Electricity Committee to substitute the three-phase alternating system for the present single-phase alternating system. When the matter came before the Council a month ago it was referred back. The Committee now reported that it had more favourable terms from a large firm, whose offer induced the Committee to suggest the substitution. Messrs. Heenan & Froude guaranteed to take current for four years—not less than £500 worth annually. The cost of introducing the system will be £5,400, of which it is proposed to pay £3,375 out by loan and the rest out of revenue. The annual expense for four years is estimated to be £746, and after that time £240. It is calculated that the deficiency in the first two years will be £200 and £50 respectively, but against that has to be set certain plant which the Corporation takes from Messrs. Heenan and Froude. After the second year it is hoped there will be a profit. Independent of the supply to Heenan & Froude, it is expected that there will be other demands for current for power purposes.

Worthing.—Mr. J. F. C. Snell has advised the T.C. to install two 125-KW. Diesel generators, at a cost of £4,400, and to replace the battery plates by larger ones, so as to increase the ampere-hours from 600 to approximately 1,000, at an estimated cost of £900, the latter sum to be met out of the reserve fund. For new buildings it is proposed to spend £400, and a loan of £4,475 is to be applied for.

Wrexham.—Owing to representations made to the L.G.B. by Messrs. Evan Morris & Co., solicitors, who are conducting opposition on behalf of the Wrexham Gas Co. and the Wrexham and East Denbighshire Water Co., the Board has adjourned the inquiry in order to permit Messrs. Morris more time to prepare their opposition, and as they put it, render it more effective.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Extensive repairs on the tramway track in Union Street are being carried out by Messrs. Brown & Crosta, Nottingham. The firm are using their patent system, and inserting renewable plates over the rail joints.

Aldershot.—The Aldershot and Farnborough Light Railway Co. has applied to the B. of T. for an extension of time to June 4th, 1912, for the commencement and completion of the light railways authorised by the order of 1909.

Bath.—The Bath Tramways Co. has recently made an innovation which should prove of great benefit to strangers to the city. The company has trained a special staff of guides to conduct tours at home and in the district. These guides will be available for personally-conducted special tours in Bath, or far into the country, at the wish of the visitors, but the feature of the arrangement is the establishment of daily general tours round the city, which is probably what most people would require. The sum charged for the public tours includes the tram and motor-bus fares. Perhaps other companies will take the hint.

Barrow.—The T.C. has decided to extend the electric tramway system across Walney Island, and has approved a provisional agreement with the B.E.T. Co. The cost to the T.C. is estimated at £7,000.

Blackburn.—The annual report shows a loss on the electric tramways of £181, compared with a profit of £453 for the previous year. The expenditure includes traffic expenses of £3,962; general repairs and maintenance, £9,206; power expenses, £10,995 18s. 1d., the total being £37,883. The income comprises traffic revenue, £55,756; sundry revenue, £2,610 (including £1,791 for parcels); total, £58,366, leaving a balance of £20,483 to be carried to the net revenue account. This sum is insufficient to meet interest on capital, repayment of loans and contributions to sinking fund.

Bradford.—The Tramways Committee has decided to recommend the City Council to purchase the block of premises extending from Hall Ings to Leeds Road, comprising on the Hall Ings side the offices and parcels department of the City tramways, and on the Leeds Road side a warehouse. The agreed price is £16,000.

Burnley.—The chairman of the Tramways Committee reported at the meeting of the T.C. that the negotiations with the Nelson Corporation, Brierfield D.C. and the Reedley Hallows P.C. as to the rents to be paid by the Burnley Corporation for the use of the tramways within those districts, and the price to be paid the Nelson Corporation for electricity supplied to the tramways, had been concluded. For the Burnley cars run in its district the Nelson Corporation will supply electricity at 2d. per unit, and instead of Nelson supplying power for the Brierfield district, the Burnley electricity department will supply what is needed at 1·2d. per unit. The rents to be paid by the Burnley Corporation during the next 14 years are: To Nelson, £692 and £150 per annum, the last-named figure being towards cost of repairing permanent way; to Brierfield, £1,000 per annum, and to renew the track, &c., before the end of the 14 years; and to Reedley Hallows £130 per annum.

Three single-deck cars are to be purchased by the Tramways Committee.

Continental Notes.—FRANCE.—A scheme for the adoption of electric traction on about 40 miles of the Chemins de Fer Economiques du Nord, in the Valenciennes, Angin and Denain districts, is at present under consideration.

RUSSIA.—La Société des Tramways de Kischineff is in negotiation with the municipal authorities of Kischineff with reference to the conversion of the tramways in the town to electric traction.

BELGIUM.—La Société des Tramways du Pays de Charleroi has secured the concession for the construction and working of a new line of electric tramway between Charleroi and Couillet.

SWITZERLAND.—A concession has just been granted for the construction of a narrow-gauge electric railway between Brigue and the Aletsch Glacier, near Lake Maerjelen. A portion of the line will be on the rack-and-pinion system.

SAXONY.—The A.E.G., of Berlin, has just secured a concession for the construction of a light electric railway between Merseburg and Mucheln.

Dunfermline.—A conference took place last week between the magistrates and Mr. Balfour, chairman of the Dunfermline and District Tramways Co., regarding the delay in completing the system. For some time the inhabitants of the West End have been clamouring for a service, and at an indignation meeting there were loud protests against the delay, while the T.C. was urged to protest against the company getting an extension of time. It is stated that it would cost £13,000 to extend the tramways as desired. Another conference between the magistrates and the directors of the company will take place.

Hull.—The T.C. proposes to purchase 24 new tramway cars and to extend the car depôt.

The B. of T. has sanctioned the extension of the tramway on the Hedon Road to Marfleet Avenue.

London.—The B. of T. inspection of the Brighton Co.'s Crystal Palace lines, which have been converted to electrical working, took place on Friday last, and it is hoped that the electrical train service will be started before the 12th inst.

Preston.—At the T.C. on April 27th, the chairman of the Tramways Committee said the gross profit on the tramways for last year amounted to £15,451, and the net profit to £4,379. This would be added to the reserve fund, which now amounted to £25,225. They had paid £60,000 for interest and sinking fund, and £20,000 to the rates since the commencement. The income for the year was £37,490, against £37,840, showing a falling-off of £350. The passengers numbered 8,412,567, against 8,484,589. Parcel traffic had increased by £283. They had paid out of profit the old tramway debt of £1,363, £4,630 in interest and commission, £4,610 to sinking fund, £202 for levelling and sewerage, and £174 for a cooling tower, leaving a net profit as above.

Salford.—On Saturday last there was a serious subsidence of the roadway in New Lane, Peel Green, owing to the bursting of a water main belonging to the Manchester Corporation. The subsidence caused the suspension of the traffic on the Salford Corporation's system in the New Lane district until the beginning of this week, when repairs had been effected.

South Shields.—The L.G.B. has written to the Corporation, stating that it intends to hold an inquiry into the Corporation's application for sanction to borrow £8,960, for the purpose of extending the electricity plant.

Sunderland.—The motormen and conductors in the employ of the Tramways Committee have applied for double pay on Coronation Day. They have further applied for a reduction of their hours to nine hours per day, or 54 per week of six days; that the rate of wages be so altered as to give the men the same pay for a week of 54 hours as for the present working week of 60 hours, and that time and a quarter be paid for all overtime beyond 54 hours. A Special Committee has been appointed to deal with the matter.

U.S.A.—It is reported that after many months of negotiation a merger of the elevated railroads of Chicago has been arranged. It is stated that $22,000,000 of new capital has been secured in the East. The properties to be united are the North-Western Elevated Railroad, the Chicago and Oak Park Elevated Railroad, the Metropolitan West Side Elevated Railway, the South Side Elevated Railroad, and the Union Elevated Railroad which operates the loop. The total capitalisation of these lines is $103,151,000, and the total mileage 169·45.—*Electric Traction Weekly.*

Walthamstow.—The annual report of the tramway manager, for the 12 months ended March 31st, states that the traffic revenue for the year exceeded all previous records, and amounted in round figures to £36,000. This is £2,000 in excess of the previous 12 months' receipts, and shows an advance since the first year of operation of over £12,000 per annum. In 1907 the income increased over the previous year by £4,000, and since then it has steadily gone up by about £2,000 per annum. This consistent advance is evidently the result of the increased popularity and usefulness of the service, rather than of any exceptional circumstance giving a mere passing fillip to the undertaking. Various circumstances combined to make the working expenses unusually heavy last year. The inter-running with West Ham and Leyton, and the consequent speeding-up of the car service, resulted in a greater consumption of energy. For the 12 months under report they paid the electricity department £7,779, as against £7,139 in the previous year. It was hoped in the future to counteract this increase by the use of traction meters. The annual wages bill for motormen and conductors increased by about £350, but this was a small item compared with the amount paid in wages—viz., £12,000. On account of the abnormal increase in expenditure the net profit would probably be less than in the preceding year. However, the net surplus, he estimated, would amount to between £600 and £700. The car-miles run amounted to 910,877, as against 881,111 in the previous year. The receipts per car-mile were 9·45d., being the highest average yet obtained, and ·17d. over the preceding year. The inter-running arrangements with West Ham and Leyton had resulted very satisfactorily.

York.—The returns of the city tramways for the year ended March 31st, show receipts amounting to £17,123, or 8·915d. per car-mile, giving a surplus of £1,868. The Committee proposes to apply £850 to the relief of the rates, at the request of the Finance Committee. The Electricity Committee also proposes to appropriate £800 out of the surplus on the renewal fund to the relief of the rates.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephony.—A common-battery automatic telephone exchange has been opened at Spokane, Washington, U.S.A.; it was made by the Automatic Electric Co., of Chicago, and has a capacity of 10,000 lines, of which 5,000 are already installed. It is expected that 10,000 telephones will be ready for operation by the end of the year.

Central America.—The rate for telegrams to all places in the Republic of Colombia, except Buenaventura, has been changed to 3s. 9d.; to Buenaventura and Ecuador, 3s. 6d.

Telephone Transfer.—Mr. F. Faithfull Begg will deliver an address to the members of the London Chamber of Commerce on May 18th, on the subject of "The Telephone: State Monopoly and Popular Control" in support of the proposal for the establishment of a public telephone authority.

It is stated that the cost to Manchester, in one direction, of the transference of the telephone system to the Post Office will be about £2,500 a year. At present the National Telephone Co. pay over £2,500 in respect of the placing of wires under the streets, but the Postmaster-General, under the Telegraph Acts, can use streets and roads rent free.

Wireless Telegraphy.—Wireless stations are to be erected in Germany at Swinemünde, Königsberg, at the mouth of the Eider near Tönning, on the Island of Sylt, and at the new naval school at Flensburg.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 19th. Six 60-K.V.A single-phase transformers, for the Melbourne City Council. See "Official Notices" April 28th.

May 26th.—(*a*) 1,024,000 arc lamp carbons, (*b*) 6,000 metal-filament lamps, for the Melbourne City Council. See "Official Notices" April 28th.

May 30th.—One portable petrol-driven desiccating plant, for the P.M.G.'s Department in Victoria. See "Official Notices" April 7th.

May 31st.—7,000 insulators and wire and line material, for the P.M.G.'s Department in South Australia. See "Official Notices" April 7th.

June 7th.—Two nauts of submarine cable, single core, for the P.M.G.'s Department in New South Wales. See "Official Notices" April 28th.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

June 14th.—Cable, ironwork, cast-iron pipes, iron or steel poles, phosphor-bronze wire, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" to-day.

June 27th.—1,400 protectors for use on main distributing frame at magneto exchanges, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

Barnes.—May 9th. Combination de-oiling, softening and feed-heating plant, for the U.D.C. electricity works. See "Official Notices" April 21st.

Belgium.—May 17th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science). Tenders for the laying of the underground armoured cables required for the extension of the mains in connection with the light electric railways in the Charleroi district.

Birkenhead.—May 8th. Washed slack or washed small coal, for the Corporation generating stations, for a year. W. Wyld, Borough Electrical Engineer and Tramways Manager, Craven Street.

Dewsbury.—May 15th. About 4,000 tons of small steam coal, for the Corporation Electricity Works, for a year. Borough Electrical Engineer.

Germany.—May 20th. The Electrical Committee of the Municipal Council of Frankfort-am-Main is inviting tenders for the supply of two 7,500-KW. steam turbines and dynamos.

It is reported the municipal authorities of Cologne are about to invite tenders for the supply of 80 open and 43 covered tramcars for use in connection with the Cologne electric tramways.

Hornsey.—May 19th. Water-tube boiler, automatic stoker, piping, &c., for the T.C. See "Official Notices" to-day.

Ilford.—May 9th. Distributing switchboard, feeder cable and stoneware conduits, for the U.D.C. Electricity Department. See "Official Notices" April 21st.

Leyton.—Electrical illumination of the Town Hall and two branch libraries on Coronation Day, for the U.D.C. See "Official Notices" to-day.

London.—St. Pancras.—May 15th. (*a*) Three-phase high-tension cable; (*b*) stoneware ducts for the B.C. See "Official Notices" April 28th.

May 5th and 10th.—(*a*) Electric gas torches for one year, (*b*) opal lamp shades for three years, for H.M. Office of Works. See "Official Notices" April 21st.

Hackney.—May 25th. 100,000 pairs of yellow flame arc lamp carbons, for the B.C. See "Official Notices" to-day.

Margate.—May 8th. Electric lighting of the Fort Concert Pavilion, for the Corporation. See "Official Notices" April 21st.

New Zealand.—June 15th. The Imperial Trade Correspondent at Auckland (Mr. A. J. Denniston) reports that tenders are invited by the Electricity Department of the Auckland City Council for the supply of (1) boiler-house equipment, and (2) engine-room equipment for the electric power station at that place. A deposit of £1,000 is required in respect of each of the contracts. Specifications may be seen at the Commercial Intelligence Branch of the Board of Trade.

June 6th.—Post and Telegraph Dept. Fifty tons galvanised-iron telephone wire (150 lb. to the mile). Specification to be seen at the Board of Trade Commercial Intelligence Dept., London.

Norwich.—May 9th. 4,000 tons of washed steam peas, and 4,000 tons of slack, for the Corporation Electricity Department. F. M. Long, City Electrical Engineer.

Oldham.—May 10th. The Corporation Tramways Committee is inviting tenders for constructing about 270 yards of tramways in Market Place and Rochdale Road. Specifications, &c., from the Borough Surveyor (£1 1s., returnable).

Plymouth.—May 15th. 8,000 tons of small-size, clean, high-grade steam coal for use in coking mechanical stokers, for the Corporation Electricity Department. E. G. Okell, Borough Electrical Engineer, Prince Rock (returnable deposit £1).

South Shields.—May 24th. One 1,500-KW. high-pressure impulse-type steam turbine, with surface condenser and pumps, coupled to one 1,000-KW. D.C. generator, with switch panel and instruments, and one 1,100-KW. A.C. generator, with switch panel and instruments, in tandem, for the Corporation. See "Official Notices" April 21st.

Spain.—The municipal authorities of Figueras (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of five years.

Turkey.—June 14th. H.M. Consul-General at Constantinople reports that tenders are invited by the Turkish Ministry of Public Works, Constantinople, for a concession for the public distribution of electrical energy and for electric tramways in Jerusalem and its suburbs. For further particulars see this column for April 14th.

July 15th.—Tenders are invited for a concession for an electric tramway system and the distribution of electricity throughout the town of Aleppo. For further particulars see this column last week.

CLOSED.

Accrington.—The tender of Messrs. W. T. Glover & Co., Ltd. (£4,333) for the supply of extra-high-tension main to be laid from Accrington Electricity Works to Baxenden boundary, has been accepted by the committee. The same firm has secured the contract for twelve months' supply of electric cables. The tender from British Thomson-Houston Co., Ltd. (£428) for the supply of high-tension sub-station switchgear has also been accepted.

Australia.—Melbourne.—The lamp globe contract mentioned last week was secured by Messrs. Harry Wittusen & Co., not as already stated.

Belgium.—No fewer than 13 concerns submitted tenders to the municipal authorities of Ixelles, near Brussels, for the supply of the armoured cables required for the low-tension mains. The contract was divided into two sections, the lowest tender for the first lot being that of Messrs. Felten & Guilleaume, of Mulheim-am-Rhine, and for the second that of M. A. Sarens, of Etterbeck, Brussels.

Bolton.—The Tramway Committee has accepted the tender of the North-Western Steel Co., for rails and fishplates, and that of Hadfield's Steel Foundry, Ltd., for points and crossings.

Burnley.—The Corporation has accepted the tenders of the B.T.-H. Co. for electric motors up to 5 H.P., and spare parts, required during the year; Messrs. Dick, Kerr & Co. for electric motors from 6 H.P. up to 20 H.P., and spare parts; Messrs. Ferranti, Ltd., for starters.

Hertfordshire.—The County Council has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., to construct a tramway from Callow Land to the car-station site in London Road, at £31,478.

Leyton.—The U.D.C. has accepted the tender of Messrs. Bertram Thomas for a 600-KW. traction panel, at £98, and for a lighting panel, at £116.

Liverpool.—The Mersey Docks and Harbour Board has accepted the tender of the Edison & Swan United Electric Light Co., Ltd., for a combined motor-generator.

London.—HACKNEY.—The Electricity Committee has received tenders as follows :—

TWO WATER-TUBE BOILERS.

Hawksley, Wild & Co.	£3,089
Clarke, Chapman & Co.	2,644
Babcock & Wilcox, Ltd. (recommended)	2,570
Howden Boiler Co.	2,500

The heating surface in the lowest tender was only 3,130 sq. ft., as against 4,226 sq. ft. in that of the accepted tender.

TURBINE FEED PUMP.

Babcock & Wilcox, Ltd.	£258
Rees Roturbo Manufacturing Co.	258
Clarke, Chapman & Co.	257
Jens Orten Böving & Co.	225
Holden & Brooke	219
British Westinghouse Co.	205
Sun Patent Evaporator Co.	172
Hayward, Tyler & Co. (recommended)	165
British Electric Plant Co.	131

The lowest tender is for a pump which is not entirely to specification.

For the reconstruction of a portion of the coal-conveying plant the tender of Messrs. Babcock & Wilcox, Ltd., at £445, is recommended.

STEPNEY.—The Electricity Committee is placing a contract with Messrs. Thomas Crow & Sons for moulded pitch to March, 1912, at £1 19s. 6d. per ton.

For decorating and illuminating the Whitechapel Library, the Mile End Library, the St. George's Town Hall, and the Limehouse Town Hall, for the Coronation, tenders were received as follows :—

Duncan Watson & Co.	£216
J. Edgington & Co., Ltd. (recommended)	294
J. Defries & Sons	300
Durell & Co.	343
Piggott Bros. & Co., Ltd.	512

POPLAR.—The B.C. received the following tenders for two 250-KW. converters, together with auxiliary plant and switchgear complete, for the sub-station at Orchard Place :—

British Westinghouse Co. (rotary converters) (accepted)	£1,830
British Thomson-Houston Co. (rotary converters)	1,859
Bruce Peebles & Co. (motor converters)	2,110

Rugby.—The U.D.C. has accepted the following tenders :

Mr. J. Young, Rugby.—Transformer chambers and cable-laying.
Thos. Wragg & Sons, Ltd., Swadlincote.—Troughs and covers.
Dussek Bitumen Co., Ltd.—Bitumen.

Russia.—The Adams Manufacturing Co., Ltd. have secured an order for a complete installation of their Adams Igranic metallic theatre dimmers for one of the largest theatres in Russia, situated in St. Petersburg, the contract having been received through their agents in that city, Messrs. Robert Kolbe & Co. The contract was secured in the face of close foreign competition.

Southampton.—The T.C. Works Committee has accepted the tender of Messrs. McWhirter, Roberts & Co. for the annual supply of electric lamps to the Department.

Stoke-on-Trent.—The T.C. Electricity Committee has accepted the tender of Messrs. Siemens for two induction motors for the new power station at Hanley, at £2,385.

Walthamstow.—The U.D.C. has accepted the following tenders in connection with the electrical undertaking :—

A. Wright & Co.—Self-recording pressure gauge.
W. T. Henley's Telegraph Works, Ltd.—Annual supply of cable.
W. E. Moore & Co.—Steam winch, £30.
British Westinghouse Electric and Manufacturing Co., Ltd.—New cylinder for gas engine, £82.

Worthing.—The Electricity Committee has accepted the tender of the Hart Accumulator Co., Ltd., for replating the storage battery at the Borough Electricity Works, and its maintenance for ten years for the total sum of £1,580, namely, £865 for replating the battery (less allowance for materials of old battery) and £715 for maintenance. Ten tenders were sent in, and one of these, that of the Electrical Power Storage Co., Ltd., gave £573 for the replating and £1,000 for maintenance, or a total of only £1,573, but the committee explains that this tender did not strictly comply with the specification prepared by the engineer. The other tenders received were as follows :—

	Replating.	Maintenance.	Total.
Premier Accumulator Co.	£847	£840	£1,687
Chloride Electrical Storage Co.	654	1,110	1,764
Pritchett & Gold, Ltd.	786	1,200	1,986
D.P. Battery Co.	905	1,200	2,105
" " "	950	1,150	2,100
Tudor Accumulator Co.	1,139	1,270	2,409
" " "	1,024	1,270	2,294
" " "	946	1,270	2,216

Benefit Concert.—The Electrical Trades Union (West London Branch) has organised a benefit concert, which is to be held at 8 p.m. to-morrow (Saturday) night at Fulham Town (small) Hall, on behalf of "Bro. Jim Foote," who, we are informed, was seriously injured a year ago by an electric shock, which has since prevented him from working at his trade. We understand that out of sympathy for him in his unfortunate circumstances, and also in recognition of the service rendered by him at different times in the interests of his fellow-craftsmen, this effort is being made. Tickets are being offered for sale at 6d. and 1s. by the secretary, Mr. W. J. Webb, 98, Coomer Road, Fulham, S.W., or they may be obtained at the doors.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers (Graduates' Association).—Monday, May 8th. At 8 p.m. Paper on "The Application of Liquid Fuel in Industries," by Mr. O. Wickham.

Institution of Electrical Engineers (Glasgow Local Section).—Tuesday, May 9th. At 8 p.m. At 207, Bath Street, Glasgow. Annual general meeting.

Junior Institution of Engineers.—Wednesday, May 10th. At 7.30 p.m. At the I.E.E. Paper on "Notes on Illumination by Gas and Electricity," by Mr. F. J. Hawkins.

Saturday, May 13th.—At 3 p.m. Visit to the National Physical Laboratory.

Institution of Electrical Engineers.—Thursday, May 11th. At 8 p.m. Paper on "The Driving of Winding Engines by Induction Motors," by Mr. H. J. S. Heather.

Physical Society.—Friday, May 12th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "Stream Lines Past the Elliptic Cylinder and Magnetic Interpretation," by Sir G. Greenhill and Col. R. E. Hippisley; "The Method of Constant Rate of Change of Flux as a Standard for Determining Magnetisation Curves of Iron," by Messrs. J. T. Morris and T. H. Langford; and "Demonstration of an Electric Thermo Regulator," by Prof. H. L. Callendar.

Association of Engineers-in-Charge.—Saturday, May 25th. Visit to the Bank to Liverpool Street extension of the Central London Railway. Assemble at Messrs. J. Mowlem & Co.'s offices at 3 p.m.

NOTES.

Turin Exhibition.—This Exhibition was opened by the King of Italy on April 29th. We shall publish next week a list of the British firms exhibiting machinery and scientific instruments.

Old Ferrantians' Dinner.—A unique gathering of electrical men assembled on Saturday last at the Trocadero to do honour to Mr. S. Z. de Ferranti. They were all old Ferrantians, and comprised electrical engineers who had been associated with Mr. Ferranti both in the early days of the Deptford undertaking and at his works in Charterhouse Square, London, and afterwards at Hollinwood, Lancs. The function was occasioned by the fact that Mr. Ferranti is this year President of the Institution of Electrical Engineers, and his nomination as President for the second year in succession was happily coincidental with the date fixed for the dinner. The chair was taken by Mr. C. P. Sparks, and about 60 old Ferrantians were present, many of whom had travelled long distances for the purpose of attending the dinner.

Mr. C. P. Sparks, in proposing the health of Mr. Ferranti, said he was gratified to notice that practically every period of Mr. Ferranti's work was represented, from the "Old Guard" in the Deptford days to the heads of Hollinwood at the present time. He referred to the magnetic influence of Mr. Ferranti and the beneficial effect which it had had upon all electrical men who had been associated with him, particularly those engaged on his staff. As a memento of the gathering each guest had been presented with a small piece of the original 10,000-volt concentric main which was laid from Deptford to the Grosvenor Gallery, and had been in use for 21 years. These pieces of cable had been made up by Mr. G. W. Partridge, chief engineer of the London Electric Supply Corporation, and presented by him as menu-holders. Mr. Sparks reminded his audience of the work which Mr. Ferranti had been doing as President of the Institution of Electrical Engineers during the past year—his efforts to consolidate electrical interests, and his earnest wish that the Institution itself might prove more helpful to the members connected with it and to the entire electrical industry throughout the country. He felt sure that during his next term of office Mr. Ferranti would be able to carry towards practical realisation the good work he had done. In proposing the toast, Mr. Sparks presented Mr. Ferranti with a solid silver inkstand, which had been subscribed for by old Ferrantians in all parts of the country. The toast was drunk with great enthusiasm.

Mr. Ferranti, on rising to respond, was visibly moved by the ovation he received. He expressed his sincere thanks for the present, which he would prize in remembrance of his association with his staff from the early days to the present time. He looked upon the gathering as unique in the annals of the electrical industry. He could see men around him who had assisted at the initiation of public electricity supply in the early eighties. He also felt that the assembly typified the extraordinary progress which had been made since his first introduction to the industry. Mr. Ferranti expressed his pleasure at being elected to remain in office as president of the Institution for another year, and referred briefly to the plans he hoped to develop whereby the members of the Institution could be mutually more helpful than heretofore, and something might be done to restrict the undue amount of competition which seriously threatened the progress of the industry.

Mr. Haydn T. Harrison proposed the toast of "The Chairman," which was received with enthusiasm, and Mr. Sparks replied in a humorous speech.

The proceedings, which terminated at a late hour, were concluded by a vote of thanks to Mr. W. E. Warrilow, hon. secretary.

Institution and Lecture Notes.—Liverpool Engineering Society.—At the annual meeting on April 27th, Mr. J. K. Catterson Smith, A.M.I.E.E., read a supplementary paper to one he had already contributed on "The Manufacture of Turbo-Electric Generators and some of the Applications to Marine Work." In the discussion that followed, Prof. Marchant expressed the opinion that in regard to the application of the turbo-electric generator to marine work, electrical engineers were most unfortunate in that they had never been able to persuade ships' engineers to make experiments on a large scale. Mr. W. J. W. Bruce referred to the almost unbearable noise of the turbo-electrical gearing, which he feared would quite put it out of the market so far as passenger-carrying vessels were concerned, unless it were considerably reduced. One great necessity, in his opinion, was facility for quick manœuvring. This was the difficulty of engineers to-day, as was evidenced in the case of the oil engine. Prof. Aball said mention had been made of the direct-current motor and the proposed pressure of 1,000 volts, but up to the present no higher voltage than 220 had been adopted in marine work, and very few electrical engineers would care to take the responsibility of such a high voltage as 1,000 on a metal-constructed ship.

Association of Mining Electrical Engineers. — At a meeting of the West of Scotland branch on April 21st, the discussion was resumed of the paper contributed by Mr. J. R. Benson, Dennyloanhead, on the subject of "Compressed Air *v.* Electricity in Mines." Mr. Alexander Anderson asked if it was fair of Mr. Benson to contrast electrical plant nine years ago, when the industry was absolutely in its infancy, with a rival grown to manhood. The figures he had given them would not hold good to-day. Mr. Benson could not be serious in advancing as an argument ventilation by compressed air. He (Mr. Anderson) could not agree that it was easier to deal with water and haulage by compressed air than by electricity, unless there were only a few pailfuls of water in the 24 hours. There was one incontrovertible fact which could readily be proved, namely, that whatever its merits the efficiency of compressed-air transmission was essentially low.—Mr. Wm. Brown, Hamilton, said that while he agreed with the author that there was still a sphere of usefulness for both forms of energy in the many intricate problems incidental to mining, he considered electricity far superior to compressed air. He could see no reason why an electric plant should not last as long as a compressed-air plant under the same care and supervision. Apart altogether from the trouble arising from leaky joints and broken pipes, due to the constant movement of the sites and pavement in the pipe roads, it was surely very much easier to take an inch cable through the low and confined roadways of an 18-in. or 20-in. seam than a malleable iron pipe of 2½-in. or 3-in. diameter. He could call to mind a case where coal-cutting by machines had to be abandoned because, owing to the pavement heaving, broken pipes and leaking joints were of daily occurrence. After adopting many expedients the pipes had eventually to be taken out, and it was his opinion that if electricity had been available in that colliery it would have been a complete success. There was no reason why electricity might not be a comparatively safe agent if suitable apparatus were installed and maintained.

Messrs. D. Martin, W. L. Spence and the president all having instanced cases of the comparatively low efficiencies of compressed-air plant, Mr. Benson briefly replied. He maintained that all the critics had missed the point which he had endeavoured to make in his paper. He did not question the higher efficiency of electrical as compared with compressed-air plant, but had advocated strongly the use of such plant in a troubled field where the seams were not 2 ft. in thickness. It was under such conditions—the coal seams were the thinnest and the field the most troubled in Scotland—that he had been able to demonstrate in his own case the efficacy of compressed-air plant as contrasted with an electrical installation ; time and experience had proved to him that compressed air, under the prevailing conditions, was safer and more economical.

Lancashire and Cheshire Municipal Tramway Managers' Association.—The quarterly meeting was held at Blackpool on Friday last. Members assembled at the Town Hall, where Alderman J. Brodie, J.P., chairman of Blackpool Tramways Committee, held a reception. After the business transaction, the members were conducted round the Corporation electricity works and tramway depôt. They also visited the depôt at Squire's Gate of the Blackpool, St. Annes and Lytham Tramways Co. In the evening they were entertained to dinner.

Institution of Civil Engineers.—The Council has awarded a George Stephenson Gold Medal to Mr. Philip Dawson for his recent paper.

Parliamentary.—Third Readings.—In the House of Lords on April 27th, the following Bills were read a third time and passed :—Sidmouth Gas and Electricity Bill, Winchester Corporation (Electric Supply) Bill.

Insulated Aluminium Cable.—We have received from the British Aluminium Co., Ltd., a copy of a table which they have prepared, in accordance with the specification of the Engineering Standards Committee, which gives the aluminium equivalents of standard sizes of paper-insulated and lead-covered copper cables, and a curve showing the minimum saving per mile in the manufacture of this class of cable, based on raw copper at £60 per ton, and aluminium wire at £93 6s. 8d. per ton. The fact that covered aluminium cables are now coming into use, and have actually been adopted in a number of cases, cannot be ignored, and these data will be found very useful. The company will be pleased to send copies of the tables to any of our readers who may be interested.

South-Western Polytechnic Students' Association Dinner.—The ninth annual dinner of this Association was held at Frascati's Restaurant, Oxford Street, on Saturday evening, the 29th ult. The Principal, Mr. Sydney Skinner, was in the chair, and the principal guest was Mr. Cecil Lubbock, a member of the governing body of the Polytechnic.

In the course of a few remarks, in proposing the toast of "The Association," the Principal said that certain difficulties introduced by the Board of Education had now been satisfactorily surmounted, and that extensions to the premises would shortly be made.

Mr. A. J. Makower proposed the toast of "The Guests," and Mr. Cecil Lubbock suitably responded.

Inquiry.—The makers of electric muffles capable of working at 1,000° C. are asked for.

The Veil Withdrawn.—"Theodore N. Vail, president of the American Telephone and Telegraph Co., and president of the Western Union Telegraph Co., accompanied by Mrs. Vail, recently sailed on the steamer *Cedric* for a four months' tour of France and Spain. Mr. Vail said he was making the trip to obtain rest."—American *Electrical Review*, April 22nd, 1911.

"The agreement between the Western Union and Anglo-American Telegraph Companies was signed yesterday. . . . Mr. Theodore Vail . . . is returning to the U.S. immediately."—London *Financial Times*, May 3rd, 1911.

Mr. Vail left for New York in the *Adriatic* on Wednesday.

Battery Economics.—In reading in abstract his paper on this subject (abstracted elsewhere in this issue), Mr. A. M. Taylor made a number of additions ; the following is the substance of his supplementary remarks, which were received too late for inclusion with the paper :—After further figures showing the advantage of boosters, as compared with regulating cells, the author also gave an application of the figures given in his tables to the Dickinson Street load. The load curve (published in our issue of July 22nd, 1910, page 141) represented roughly an area corresponding to 93,800 units per day, or. say, 33,800,000 units per annum on a 35 per cent. load factor. He compared the cost of putting in steam plant for the whole 11,200 KW. with the cost of putting in steam plant for 5,200 KW. and battery plant for 6,000 KW. at a 1½-hour rate, which would supply a two-hour peak. The fixed charges for the 11,200-KW. plant at £3·89 per KW. per annum are equal to £43,500, and the "true" running costs, at, say, 0·15 of a penny per unit = £21,100, giving a total of £64,600 for the all-steam scheme. Considering, now, the battery scheme we have as follows :—5,200 KW. of steam plant at £3·89 per KW. per annum = £20,200 per annum ; to which add 6,000 KW. of battery plant at £1·58 per KW. per annum, or £9,480 per annum, giving a total for fixed charges of £29,680 per annum. To this add £21,100 for running charges, as for steam, and to this again add £1,200 for lost units in the battery and boosters, giving a total for the battery scheme of £51,980. But as no margin is provided in the battery plant beyond that of the normal peak it is desirable to provide a second battery (which might be of the Exide type), for use solely for emergency conditions, having a 6,000 KW. capacity for 1½ hours. This battery would add to the fixed charges a sum of approximately £6,300 per annum (6,000 KW. at £1·05), making a total of £58,280, thus giving a saving of £6,320 per annum over the cost of the all-steam plant. It may be mentioned that in the £43,500 given in the steam scheme for the fixed charges, there is included a sum of £3,100 on the 6,000-KW. plant representing stand-by coal, which is entirely saved on the battery scheme.

Faraday House O.S.A.—The seventh annual dinner of the Faraday House Old Students' Association took place at the Holborn Restaurant on Wednesday, April 26th, Mr. H. H. Perry, the President, being in the chair. Amongst the guests present were Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers, Prof. J. D. Cormack, Mr. W. Duddell, F.R.S., Mr. J. S. Highfield and Mr. Arthur Wright. Mr. S. Z. de Ferranti, in proposing the toast of "Faraday House and its Old Students," referred to the good work which had been done by Hammond College and its successor—Faraday House. Mr. Robert Hammond, in replying, reminded the company that although this was only the seventh annual dinner of the Old Students' Association, it was actually the twenty-sixth annual dinner of the Old Students. Mr. D. Wilson proposed the toast of "The Chairman," whilst "The Visitors" was given by Mr. A. F. Berry and replied to by Mr. W. Duddell.

International Electrotechnical Commission.—The second annual report of the Commission has just been issued, covering the period to the end of last year. The full meeting, which was to have been held in Berlin this year, has been transferred, by the courtesy of the German Committee, to Turin, where an International Electrical Congress is also to be held, and will take place on September 11th to 16th. The various Committees have been considering the important question of nomenclature and discussing a list of terms dealing with one subject. The choice of symbols and the direction of rotation of vectors have also been under discussion. Electrotechnical Committees have now been formed in 17 countries, in most cases with the assistance of their Governments, Holland and Switzerland being the latest adherents. A small committee, consisting of Dr. Budde (Germany), Dr. S. P. Thompson (Great Britain), M. Brunswick (France), and M. Eric Gérard (Belgium) is about to meet to discuss the work on nomenclature, and to prepare a list of terms and definitions to be submitted to the full meeting at Turin. There is every prospect that the latter will prove a highly successful function and result in material progress.

Subway Rails in New York.—The Interborough Co. has just placed an order for 5,000 tons of steel rails to cover the annual repairs. The specifications require that the carbon shall average not less than 0·85 per cent., rails to be made by open hearth process. The original rails in the subway were made by the Bessemer process, and the steel content averaged about 0·50 per cent. As these rails wore on curves, they were replaced with Bessemer rails with a carbon constituent of 0·65 per cent., which was as high as it was thought advisable to go in Bessemer steel, on account of the phosphorus, which it was difficult to reduce below 0·1 per cent. Open hearth rails were then tried, and it was found that with a carbon constituent of 0·80 per cent. the rails lasted about twice as long as the original Bessemer rails. The original rails in the subway seem to have a life of about six years on straight track and from three months to a year on the curves, depending upon the degree of curvature, and, therefore, most of the original rails have been replaced.

Experiments have been made with rolled manganese steel rails on curves, and, as a result, it has been decided to renew the rails on important curves in the subway with manganese steel rails. Manganese steel rails seem to have about five times the length of service of the original Bessemer rails. The manganese steel has a carbon content of over 1 per cent., and a manganese content of from 11 to 14 per cent., the ordinary open hearth having less than 1 per cent. of manganese.—*Electric Traction Weekly.*

Appointments Vacant.—Engineers to design and superintend the establishment of wireless telegraphy stations for the Australian Commonwealth (£600). See our advertisement pages in this issue.

Copper.—The withdrawals from stock during April, as shown by Messrs. Merton's statistical circular, have been considerably above the average for the past 12 months. The total decrease is 4,199 tons, of which 2,688 tons have been withdrawn from English ports, and 411 tons from Havre. The quantity afloat from Chile is 900 tons less than for March 31st, and from Australia 200 tons less. The stock in Rotterdam is 100 tons less, and that in Hamburg estimated to have decreased 500 tons. Supplies from North America to this country are somewhat below the average, though the quantity sent to the whole of Europe is above it. Supplies from Spain are above the average, Chile shipments a little below, and Australian the same. The deliveries for the month are fairly brisk, totalling 42,728 tons. American stocks (return for the end of March) were again increased, this time by 2,401 tons. The world's supply for the end of March thus totalled 154,592 tons, an increase of 2,281 tons over the preceding month.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Electricity and Light Railway Committee of the Darlington T.C. has recommended that the salary of MR. LUNN, electrical engineer, be increased by £50 a year for three years to a maximum of £600.

MR. FRANK RIDLEY, senior switchboard attendant at North Shields Electricity Works, is leaving to take up an appointment as shift engineer at the Durham and Cleveland Electric Power Co.'s works on May 8th.

The Hackney Electricity Committee has recommended that the salary of MR. J. R. BOWDEN, the distributing engineer, be increased from £325 to £400 per annum by annual increments of £12 10s., and his title is to be altered to "deputy engineer." It is pointed out by the Committee that for the last two years the cable-laying, which used to be done by contractors under the superintendence of the consulting engineer, has been carried out by the department's own staff under the direct supervision of Mr. Bowden.

Tramway Officials.—The staff employed by the Lancashire United Tramways Co. (South Lancs. Tramways) have entertained to dinner MR. C. H. EDWARDES, the newly-appointed manager, who succeeded the late Mr. J. R. Salter.

General.—The Lighting Committee of the Brighton T.C. has recommended that a sum of £1,000 be paid as compensation to MR. ARTHUR WRIGHT, whose engagement with the Corporation terminates on June 23rd next. Under the agreement of September 21st, 1905, Mr. Wright was entitled to commission at the rate of 5 per cent. per annum upon all profit earned by the electricity department in any year in excess of a sum of £5,000, subject to an adjustment if the charges for energy were increased or decreased. A new tariff was adopted in 1908, and Mr. Wright expressed the opinion that he was entitled to a sum of £2,000. The payment recommended is the result of a compromise on both sides to avoid litigation.

NEW COMPANIES REGISTERED.

Venner Time Switches, Ltd. (115,468).—This company was registered on April 26th, with a capital of £7,000 in £1 shares (6,625 ordinary and 375 "B"), to acquire and turn to account certain inventions relating to (1) improvements in or relating to electrical time switches, type "A"; (2) improvements in or relating to electrical time switches, type "B"; (3) improvements in or relating to electrical time switches, type "C, D and E"; (4) improvements in electrical switches, type "Selective"; (5) improvements relating to time switches for electric circuits, and more particularly for use with electric light, type "Window"; (6) improvements relating to a method of and means of controlling electric appliance in connection with electric circuits, type "G Relay"; (7) improvements relating to brake mechanism for the control of rotary and oscillating gear; (8) improvements in or relating to time switches for controlling electric circuits, or the supply of fluids through pipes; (9) improvements relating to electric switches, type "H"; (10) an improved mechanism for producing a rapidly released reset power storing action, as applied to rotary movements, motors, clocks, or any other source of power, type "R.B. Motion"; and (11) improvements relating to automatic switches, type "R.B.H."; and to adopt an agreement with R. F. S. Venner, R. C. Griesbach and E. E. Sharp. The subscribers (with one share each) are:—R. F. S. Venner, 8, Morland Road, Croydon, engineer; R. C. Griesbach, Newlands, Portsmouth Road, Kingston, electrical engineer; E. E. Sharp, 109, West Side, Clapham Common, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are R. F. S. Venner, R. C. Griesbach and E. E. Sharp (all permanent, subject to holding 150 shares); qualification of ordinary directors, £25; remuneration as fixed by the company. Registered office, 6, Old Queen Street, Westminster.

Mersey Power Co., Ltd. (114,319).—This company was registered on April 15th, with a capital of £250,000 in £1 shares, to acquire (1) from G. H. Cox and H. J. Falk all or part of the undertaking authorised by the Runcorn Urban and Runcorn Rural Electric Lighting Order, 1910; (2) from the Mayor, Alderman and Burgesses of Widnes, all or part of the undertaking authorised by the Widnes Electric Lighting Orders, 1901-10; and (3) the benefit of an agreement between the said Mayor, Alderman and Burgesses of the first part, G. H. Cox and H. J. Falk of the second part, and the Salt Union, Ltd., of the third part. The subscribers are:—W. H. Alexander, Eton House, 35, Bidston Road, Oxton, cotton broker, 250 shares; H. J. Falk, Thorshill, West Kirby, Cheshire, barrister, 250 shares; J. H. Bengle, Oak Dun, Noctorum, Birkenhead, gentleman, 1 share; C. M. Crichton, North Drive, New Brighton, gentleman, 1 share; A. E. Showell, Oakdene, Prenton, Cheshire, incorporated accountant, 1 share; G. W. Phillips, 12, Castle Road, Liscard, Cheshire, clerk, 1 share; E. C. Wickes, 140, Salisbury Road, Wavertree, Liverpool, clerk, 1 share. Minimum cash subscription, 10,000 shares. The number of directors is not to be less than two or more than seven; the first are G. H. Cox, W. H. Alexander and H. J. Falk; qualification, 250 shares; remuneration £200 each per annum (£100 extra for chairman). Registered office, Colonial House, Water Street, Liverpool.

Baxter & Caunter, Ltd. (115,516).—This company was registered on April 29th, with a capital of £50,000 in £1 shares (10,000 preference), to take over the business of electrical engineers carried on at 86, Charing Cross Road, W.C., as "Baxter & Caunter," together with the leases of the aforesaid premises and those of 1, Trentishoe Mansions, Charing Cross Road, and 17a, Arthur Street, W.C., where the said business is carried on, at a price of £27,000, and to adopt an agreement with A. Baxter, L. G. Caunter and G. W. Kettlewell. The subscribers (with one share each) are:—A. Baxter, 86, Charing Cross Road, W.C., electrical engineer; L. G. Caunter, 86, Charing Cross Road, W.C., engineer; G. W. Kettlewell, 86, Charing Cross Road, W.C., engineer. Private company. The number of directors is not to be less than three or more than five; the first are A. Baxter, L. G. Caunter and G. W. Kettlewell (all permanent); qualification, £1,000; remuneration as fixed by the company. Registered office, 1, Trentishoe Mansions, Charing Cross Road, W.C.

Electrical Fittings Co. (1911), Ltd. (115,433).—This company was registered on April 25th, with a capital of £5,000 in £1 shares, to take over the business of electrical engineers and fitters, and manufacturers and sellers of electrical fittings carried on at 38, Conduit Street, New Bond Street, W., as the "Electrical Fittings Co. Ltd.," and to adopt an agreement with W. K. Sutton and A. W. Mills. The subscribers (with one share each) are:—A. W. Mills, Burlington Cottage, Spencer Road, Chiswick, W., engineer; W. C. Towell, Ecclesbourne, 135, Rosendale Road, Dulwich, S.E., engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. W. Mills (permanent), W. K. Sutton, F. Rowe and W. Towell; W. K. Sutton is deemed to have been appointed by debenture stock holders. Registered 38, Conduit Street, W.

Charleville Electric Co., Ltd. (3,678).—This company was registered in Dublin on April 27th, with a capital of £2,000 in £1 shares, to manufacture, buy, sell and deal in electric light and power. The subscribers are:—J. R. Daly, Charleville, bank manager, 100 shares; J. Morrissey, Charleville, merchant, 50 shares; W. P. Binchy, Charleville, merchant, 100 shares; M. J. O'Mahony, Charleville, merchant, 100 shares; J. Carroll, Charleville, merchant, 100 shares; J. R. O'Connor, Charleville, merchant, 50 shares; J. P. Moran, Charleville, merchant, 100 shares. The first directors are J. R. Daly, J. Morrissey, W. P. Binchy, M. J. O'Mahony, J. Carroll, J. R. O'Connor and J. P. Moran; qualification, 50 shares. Registered by J. Binchy, Charleville, Co. Cork.

Indestructible Accumulators, Ltd. (115,259).—This company was registered on April 12th, with a capital of £12,000 in £1 shares, to carry on the business of engineers, cleaners of houses, buildings, carpets, upholstery, and furniture, manufacturers of accumulators, apparatus and engines, &c., and to adopt an agreement with the Vacuum Engineering Co., Ltd. The subscribers (with one share each) are:—J. E. Stevens, 32, Millman Street, W.C., clerk; F. G. Adkins, 240, Canbury Park Road, Kingston, clerk. Private company. The first directors are not named. Registered by J. J. Edwards & Co., 28, Sackville Street, Piccadilly, W.

Resisto-Electrical Engineering Co., Ltd. (115,334).—This company was registered on April 18th, with a capital of £7,500 in £1 shares, to carry on the business of manufacturers of and dealers in electrical apparatus of all kinds. The subscribers (with one share each) are:—H. Snowdon, 10, Walbrook, E.C., electrical engineer; H. M. Young, 24, Ely Place, E.C., barrister. Private company. Table "A" mainly applies. H. W. Quittenden is the first secretary. Registered by R. Warner & Co., 10, Walbrook, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Northwood Electric Light and Power Co., Ltd. (66,312).—Issue on March 1st of £1,150 debentures, part of a series of which particulars have already been filed.

Atlas Carbon and Battery Co., Ltd. (34,857).—Return dated December 30th, 1910, filed February 18th, 1911. Capital £2,000 in £1 shares. All shares taken up. £1 per share called up on eight. £8 paid. £1,999 considered as paid on 1,999 shares. Mortgages and charges: £5,000.

Worcester Electric Traction Co., Ltd. (74,698).—Debenture dated March 28th, 1911, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: H. E. Tovey, Worcester; and W. C. Buckley, Edmund Street, Birmingham.

Northampton Electric Light and Power Co., Ltd. (28,640).—A memorandum of satisfaction in full on January 18th, 1911, of debentures dated March 8th, 1901, and March 29th, 1906, securing £5,000 and £1,400 respectively, has been filed.

Increased Power Co., Ltd. (107,734).—A memorandum of satisfaction in full on April 7th, 1911, of debentures dated September 19th, 1910, and February 28th, 1911, securing £600, has been filed.

A. Reyrolle & Co., Ltd. (70,210).—Issue on March 30th of £600 debentures, part of a series of which particulars have already been filed.

Hindhead and District Electric Light Co., Ltd. (75,361).—Issue on June 11th of £50 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Craigpark Electric Cable Co., Ltd.

The directors' report for the year ended March 31st, 1911, states that the accounts cover the period as above and show a net profit of £6,245, which, with the balance of £671 brought forward from last account, makes the sum of £6,916. The directors now recommend the following appropriations, viz.:—Depreciation of buildings and machinery, £500; reserve account, £500; dividend (already paid) on 37,500 6 per cent. preference shares, for half-year ending September 30th, 1910, £1,125; ditto for half-year ending March 31st, 1911, £1,125; ditto on new issue of 10,000 preference shares, calculated from date of calls, £202; dividend on 37,500 ordinary shares, at 6 per cent. for the 12 months ending March 31st, 1911, £2,250; one-third of cost of new issue of preference shares, £184; balance carried forward (subject to payment of directors' fees for the past year), £1,030. The company's business continues to expand, but again the net results have been affected by the high average price of raw gutta-percha and rubber. At the moment prices are more favourable, and the directors look forward to the current year with confidence. All departments are fully employed. The stocks have been carefully gone over and certified by the managing director. To pay off part of the mortgage, amounting to £3,500, and provide extra capital to meet expenditure incurred in extending the business, an issue of £10,000 in new preference shares was made in October last and was readily absorbed by existing and new shareholders. The expense of this new issue amounted to £550, of which the directors propose to write off £184 out of last year's profits. The directors regret the death of Mr. James T. Tullis, who was chairman of the company from its inception, and took an active interest in its affairs. Mr. W. S. Brown was appointed chairman in his stead. Mr. George A. Buchanan has been appointed to fill the vacancy on the board, and his appointment falls to be confirmed at the annual meeting.

River Plate Electricity Co., Ltd.

The report of the directors for the year ending December 31st, 1910, which was submitted at the annual meeting held last Friday, states that the revenue account for the year, after providing for administration expenses, bad debts, and all necessary depreciations, amounts to £45,026; interest on the 5 per cent. debenture stock of the company requires £10,000, leaving a surplus of £35,026, plus £5,141 brought from the previous year, making in all available for distribution, £40,167. The directors propose that this sum shall be appropriated as follows:—A dividend at the rate of 6 per cent. for the year upon the preference stock and shares, £7,403; a dividend of 10 per cent. for the year upon the ordinary stock, £12,000; addition to general reserve, £14,000; further remuneration to the directors as provided by the articles of association, £875; carry forward to credit of next year, £5,889. The board have to report that the whole share capital of the Rosario Electric Co., Ltd., in which the company, since its formation, has held a large interest, was, during the year, purchased by the Société Financière de Transports et d'Entreprises Industrielles. This company received a price for its shares in excess of the price at which they were originally acquired and stood in the books of the company, and in respect of this transaction the sum of £41,000 has been transferred to the credit of general reserve. With the above sum of £41,000, and £14,000 proposed to be added this year from revenue, the general reserve is now brought up to £85,000. The business of the company, both at La Plata and Tucuman, has continued to grow throughout the year, and the prospects of further business in the current year are encouraging. In addition to the contract with the La Plata Electric Tramways Co., Ltd., for the supply of power to their system, referred to in the last annual report, the directors have recently concluded a contract with the National Tramway Co., of La Plata, for the supply to that company of all the power necessary for its system. When the electrification of the latter, now in progress, is completed, the company will supply the entire tramway systems of La Plata and Ensenada. The erection and equipment of the important new generating station of the company at Ensenada is nearing completion, and it will be in service in the early autumn. The cost will not materially exceed the original estimate, and is being wholly provided out of the company's existing financial resources. The second payment on account of the amortisation of the obligations of the German Trans-Oceanic Electric Co. (Series 1), held by this company, viz., £1,600, was duly made on April 1st, 1910, reducing the amount outstanding to £146,600. During the year 100,000 £1 preference and 120,000 £1 ordinary shares of the company were converted into corresponding amounts of preference and ordinary stock. The balance of 25,000 £1 preference shares will also be converted into stock after May 1st, from which date they rank for dividend and in other respects *pari passu* with the preference stock. The directors intend in future to pay the preference dividend half-yearly, on May 1st and November 1st in each year.

The meeting was held at the offices, Capel House, New Broad Street, E.C., Mr. M. W. Mattison, K.C., presiding.

The Chairman, in proposing the adoption of the report, said he thought they would all be of opinion that the accounts were satisfactory, both from the point of view of revenue and of capital. The revenue showed progress, and the capital account showed strength. The net revenue for the year, after deducting debenture interest, came out at £35,026, as against £27,342 last year, an improvement of £7,684. This was the eighth year of the company's existence, and he would remind them that in that time the net profits had gone up from £8,826 in 1903, to £35,026 in 1910. In other words, in that period there had been an improvement in the net profits of some 400 per cent. It was worth remarking that the capital had only been increased by £25,000, so that that large increase in net revenue had been built up by the company out of its own reserves. The income from interest and miscellaneous receipts was £10,343, which compared with £9,843, or an increase of £500. That increase was largely due to the fact that in the past year they not only received a full year's dividend upon their holding in the ordinary shares of the Rosario Electric Co., but they also received a good deal of interest on the large cash balances which they had at the end of the last financial year. As they had parted with their Rosario Electric shares, they could not expect to have quite as much under this head during the current year. The largest improvement in the revenue was derived from their two stations at La Plata and Tucuman, the income last year being £43,505, as compared with £35,323 a year ago, an increase of £8,182. After taking into account the increased depreciation, there was still a net improvement of some £7,500 in respect of the running of the two stations. To some extent the figures at La Plata were helped by the public illuminations in May last, to celebrate the centenary of the Argentine Republic. The main cause, however, of the increase was the continuous growth in the business of the company. The business continued to grow at both stations, and he had no hesitation in saying that, despite any special advantage that the past year might have had, he had no reason to doubt that the general progress of the company's business would enable the current year to outstrip its predecessor. The total of the balance-sheet this year was £616,000; last year the total was £533,490—an increase of £82,500. They had received further capital moneys to the extent of £6,800, and creditors were temporarily increased by £11,300. Those two items left £64,400, by which amount the capital assets had grown during the year. They had increased under two main heads. The first was in the additions to the plant at the stations—£44,490—to which they had to add £2,315, representing the increase in the stores, &c., making altogether an increased expenditure at the two stations of £46,806. More than four-fifths of that sum represented the expenditure upon the new station at Ensenada. Steady progress was being made at the station in the building and installation. The buildings were up, and a good deal of the plant was now in course of being installed, and they had every reason to believe that the station would be finished and running by the autumn. Their expectation was that the whole cost of that station would be paid for out of their current resources, and that it would not be necessary to raise further capital or incur debt. Sundry investments had been reduced from £17,360 to £8,447, a reduction of £8,913. On the other hand, cash had risen from £6,517 to £57,785, an increase of £51,168. Those two items of increased cash and reduced value of investments must be taken together—the difference being £42,200. It arose out of a transaction to which he referred at the last meeting. He told them that at the inception of the company, nine years ago, they received from the Rosario Electric Co. a certain portion of their original ordinary share capital in respect of the old bankrupt station at Rosario. At that time the ordinary shares of the Rosario Co. were deemed to be of little value. That company, however, had prospered, and the shares subsequently became of considerable value. The Rosario Co. was approached by a Belgian syndicate, which made it an offer for the station. The offer was a tempting one, and it appealed to the majority of the shareholders. The board of their company was not so keen about accepting the offer, as they knew the potentialities of the Rosario Co., and they would have been well content to remain as they were, and retain their shares. However, the majority of the shareholders were in favour of accepting the offer, and the transaction was carried through, and they received a sum of about £41,000 in excess of the price at which the shares stood in their books. That sum had been wholly transferred to their general reserve, and the money came in very handily in connection with their extensions at La Plata. Last year they were able to add £10,000 to the reserve; this year they had added £14,000 out of revenue and £41,000 from the sale of the Rosario Co., so that in two years they had had the good fortune to be able to add as much as £65,000 to the reserve, which now stood at £85,000, and he had no doubt whatever that in the current year it would be brought up to a round £100,000. Dealing with the present and future prospects, the Chairman said that at both La Plata and Tucuman their consumers had increased last year, and they were still increasing. That was not due to any special circumstances, but entirely to the growth in population and in

wealth of the two cities. The Provincial Government of Buenos Ayres were continuing to increase their demand for public lighting, and during the last few months they had supplied a certain number of lamps for the lighting of the docks at Ensenada. There were two other directions in which the business had increased and would increase—the one the supply of power for industrial purposes, and the other the supply for traction. There was no very great scope for extension for power in La Plata, but they might expect a considerable increase in Ensenada. They were also supplying the La Plata Electric Tramway Co. with power for traction purposes. The first section of that tramway was opened in January, 1909, and consisted of only a few miles, and as further sections were finished they proceeded to supply them. As a matter of fact, however, the company had not been able to complete their system—they had completed the electrification of the system in the City, but they had not yet completed the important link which would connect La Plata with Ensenada. It was hoped that that would be finished some time in the second half of this year, and under their contract they would supply the company with the necessary power. It was plain, therefore, that their traction business would expand in that direction, and they had also secured a contract to supply the National system of tramways in La Plata with electric power. The outlook for the future was therefore very encouraging.

Mr. Robert Miller seconded the motion, and the report was adopted.

Oldham, Ashton and Hyde Electric Tramway Co., Ltd.

The directors report a net profit of £6,834. After placing £1,250 to reserve and paying 5 per cent. on the preference shares, a dividend at the rate of 7 per cent. per annum is declared for the last half of 1910, making 6 per cent. for the year. £151 is carried forward. The state of trade in the district was unsatisfactory, and there was a decrease in traffic of £56, but economies effected led to an increase of £467 in net profit.

Mr. E. Garcke presided on Wednesday at the offices of the British Electrical Federation over the annual meeting of the company. In moving the adoption of the report, he said the position of the company was satisfactory. The trade of the district was bad, and there was a lock-out at the end of the year, and consequently fewer passengers were carried. Owing, however, to the revision of fares, they had slightly increased the receipts. The improvement in the net result was due to the reduction of management expenses. The parcels business had also paid a bit better. Altogether they were about £450 better off than in the preceding year; they put more to reserve fund and carried forward a larger amount.

Mr. J. Vincent-Kitchener (managing director) seconded the motion, and the report was adopted.

Merthyr Electric Traction and Lighting Co., Ltd.—The directors report that the total revenue for the year to December 31st, from all sources, amounted to £19,253, compared with £18,105 in 1909. The expenses amounted to £11,034, compared with £10,540, and the net revenue is, therefore, £655 more. After deducting all expenses chargeable to revenue (including £2,147 for debenture interest), and after charging profit and loss account with £1,500 for provision for renewals, there remains a surplus of £4,571, making, with the £498 brought forward, a total of £5,070. The directors recommend placing to reserve account £1,000, and, after payment of dividend on the preference shares, a dividend at the rate of 6 per cent. on the ordinary shares for the year, £1,800, leaving £457 to be carried forward. The total number of units supplied during the year was 858,625, as compared with 740,952 in 1909. The number of units sold for lighting and power purposes was 464,865, which, compared with the previous year's figure of 352,782 units, shows an increase of over 31 per cent. Having obtained the consent of the Board of Trade to the erection of overhead mains, the company is now giving a supply for the public street lighting of the whole of Dowlais, under the agreement with the Merthyr Corporation, and these mains are also being used for the purpose of private supply. The gross receipts derived from the working of the light railways amounted to £11,042, being a decrease of £21 as compared with the previous year. For a considerable portion of the year the traffic receipts were adversely affected by the unsettled trade conditions of the district.

Cuba Submarine Telegraph Co., Ltd.—The directors report that for the half-year ended December 31st last the total receipts were £18,351, while the expenses amounted to £6,673, leaving a balance of £11,678, to which has to be added £7,397 brought forward, giving a total of £19,076 to be dealt with. The sum of £2,000 has been placed to the reserve against loss on investments, and £2,000 added to the reserve fund, which now stands at £120,000. The dividend on the preference shares will absorb £3,000, and leave £12,076, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax; the balance, £7,276, being carried forward. The cables continue in good working order. Mr. James Scott, for reasons of health, having asked to be relieved of the active duties of secretary, Mr. Albert Charles Austin, the assistant secretary, has been appointed secretary, and Mr. Scott's services have been retained in a consulting capacity.

Electrical Distribution of Yorkshire, Ltd.—The seventh ordinary general meeting was held on April 25th at Leeds, Mr. R. W. Wickham presiding. The chairman said there was a considerable increase in the number of consumers during last year. At the beginning of the year 83 applications had been received, and at the end of the year these had grown to 201, which was a very satisfactory increase. Applications were still coming in in the most satisfactory manner, so that a further increase in the profit available for dividend might be reasonably anticipated as a result of this year's trading. The directors had hoped that shareholders would have been able to induce their friends to come forward and take up shares in the company, but as this had not taken place the directors had made temporary arrangements with the Yorkshire Electric Power Co. to borrow capital sufficient to commence the development of the Distribution Co.'s undertakings. The Power Co. had shown their confidence in the future of that company by agreeing to take ordinary shares at par in payment of the greater part of the amount owing at the end of 1910, bringing up the issued share capital to £17,000. During the year the Distribution Co. had been paying interest to the Power Co., but from January 1st last the Power Co. would take a dividend only on the amount represented now by share capital.

Re The Uxbridge and District Electric Supply Co., Ltd.—At the offices of the Board of Trade, Carey Street, W.C., on Friday last, an extraordinary general meeting of the above company was convened for the purpose of passing the following resolution:—"That the existing 10,000 ordinary shares of £5 each be subdivided into 50,000 ordinary shares of £1 each, numbered 1 to 50,000." The Official Receiver stated that unfortunately there was not a quorum of creditors present, consequently there was no alternative but to adjourn the meeting for a week. In order to form a quorum there should have been seven shareholders present, or represented, but he was sorry to say there were only six present. If there had been a quorum present and the resolution passed by the requisite majority it would have been submitted for confirmation as a special resolution to a second extraordinary general meeting which would have been subsequently convened, but as it was the creditors had had their trouble for nothing, and the meeting would be, therefore, formally adjourned for a week.

Elmore's German and Austro-Hungarian Metal Co., Ltd.—The report states (according to the *Financier*) that the profits of the Metall Co. (the German company) not being sufficient to permit of the payment of a dividend upon its shares, the accounts of this company show a loss of £5,383. The directors do not propose to submit now any scheme for the rearrangement of the capital of the Austrian company, and will defer doing so for a further 12 months, in case it may not be required. It will then be possible to place before the shareholders a clear report upon the Mertens' process and upon the prospects of the company generally. The accounts of this company show that the debenture stock has been slightly reduced, and now stands at £75,845, while the loan to the Metall Co. has also been reduced, and now stands at £49,932.

Arbroath Electric Light and Power Co.—The report as submitted at the annual meeting held last week under the chairmanship of Mr. George Balfour shows a profit on the year's working of £1,601, including £389 brought forward. After deducting the interest charges paid, there was shown an available balance of £1,098, which the directors proposed to carry forward to the next year, subject to the payment of directors' and auditors' fees. Mr. Balfour was re-elected chairman. This is the second complete working year of the company.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Friday, May 12th.—Cuban Telephone Co.—Scrip fully paid for £300,000 5 per cent. first mortgage convertible bonds.

Wednesday, May 17th.—Water Softeners, Ltd.—62,500 shares of £1 each fully paid, Nos. 1 to 62,500.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared a dividend for the quarter ended December 31st last of 2s. 6d. per share, together with a bonus of 4s. per share (or 2 per cent.), making a total distribution of 7 per cent. for 1910.

Eastern Telegraph Co., Ltd.—Final dividend of 25s. per cent. on the ordinary stock, and a bonus of £2 per cent., making a total of 7 per cent. for the year 1910.

West India and Panama Telegraph Co., Ltd.—Dividends of 6s. per share on the first preference, 6s. on the second preference (for six months to December, 1910), and of 1s. 6d. on the ordinary are recommended.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the three months to March 31st.

Held Over.—Pressure upon our space compels us to hold over several City meeting reports until next week.

British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. J. Annan Bryce, M.P. (chairman), presided on Monday, at Hamilton House, W.C., over the eleventh annual meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 687), the Chairman said that taking the debit side of the balance-sheet first, the items of authorised capital and debenture stock stood at the same figure as last year, but there was a decrease of £5,700 in the item of prior lien debentures, representing the debentures purchased and redeemed during the year in compliance with the terms of the trust deed. Altogether, £16,400 of these debentures had been redeemed to date. Sundry creditors and credit balances, £186,433, was about £16,000 in excess of last year owing to the increased volume of business. A large proportion of the amount, about £43,000, was in respect of retentions on contracts, which were not due to be paid until they themselves had been paid. The amount included under the term "credit balances" represented mainly the provision which it was prudent to make in respect of current engagements. Interest accrued on prior lien debentures and 4 per cent. debenture stock £28,331, was mainly in respect of the debenture stock interest, which had since been paid. The reserve for Employers' Liability remained as before, and was considerably in excess of the estimated liabilities for accidents to date. It was very creditable to the Works Organisation that by the precautions taken accidents of a very serious kind had been almost eliminated. The estimated liability in respect of accidents during the year was a little over £2,300, and the average number of men employed was about 5,000. With regard to the profit and loss, it would be observed that the debit balance of £7,320 brought forward from 1909, had been transformed into a credit balance of £5,117, or a net gain of £12,437. This represented a small proportion of the increased profits of the business during the year under review, as, in addition to the very substantial reserves already referred to for unforeseen contingencies in respect of contracts in course of completion, a sum of nearly £18,000 more than last year had been written off to depreciation. The trading profit was £112,539, as compared with £84,136 last year, or an increase of £28,383, though the percentage of profit to output was somewhat lower than last year owing to lower prices. The directors, however, hoped that with a continuance of the improvement in trade, a higher rate of profit might be realised. Coming to the credit side of the balance-sheet, the works at Trafford Park and their equipment stood on the books at the close of 1909 at a value of £1,706,516. At the close of 1910, notwithstanding an additional expenditure of £10,898, they stood at £1,687,440, or a reduction of £19,076. This difference was arrived at by the writing off to depreciation out of revenue the sum of £29,974, including £5,550 taken from the prior lien redemption fund account, and representing the cost of the debentures redeemed during the year. This was the first year that the profits had enabled them to make so large a provision for depreciation, and, in addition, a large sum had, as usual, been spent out of revenue on maintenance. While on the subject of depreciation, it may be well for him to remind them that in many respects their works were originally designed on too lavish a scale. When the capital of the company was reduced in 1907, a large provision was made to meet this, but since then it had been decided to close down the steel foundry, and for the present they had postponed the idea, then entertained, of building large horizontal gas engines. He mentioned this matter merely to indicate that before they could enter upon a dividend-paying stage, some plan would have to be devised for bringing capital cost to a lower figure. Before making any proposals to this end, the directors thought it well to await the result of the appeal in the arbitration, to which allusion was made in the report. If the result of the appeal was to confirm the award, a very serious loss would have to be faced, and that would be the proper occasion for considering what proposals should be made for writing down capital. He should say that the contract out of which this trouble had arisen was made at the very beginning of their career, and that no responsibility for it attached to the present board or staff. Office furniture equipment, &c., London and branch offices, £4,199, showed a small increase of £661. Stock of material on hand and in process of manufacture for contracts and stock at cost, was £533,155. This showed an increase of £103,816, due to the large increase of sales over those of 1909. The larger their business, the more material and stock they required. Completed work on contracts, &c., £394,304, compared with £393,241 last year. In this figure was included the amount outstanding in connection with the award, to which allusion had already been made, and for which, so far, no provision had been made in the accounts. Sundry debtors were £166,389. There was an addition here of just over £30,000, which was due to the increase of shipments. Taking these last two items together, they amounted to £560,693, while the sundry creditors and credit balances on the other side of the accounts only amounted to £186,433. The large excess of the credit items was, of course, a testimony to the strength of the financial position. Patent renewal fees, &c., £3,878, compared with £5,395 last year. Prior lien debenture expenses, £12,977, was reduced by £809 since last year, including a small item of profit realised by the purchase of £5,700 of these debentures in the open market below par. Shares and debentures in other companies, £286,415, was slightly less than before, owing chiefly to the sale of a small lot of debentures at a profit. The main items in this account were their holdings in the Clyde Valley Electrical Power Co., the Traction and Power Securities Co., Ltd., and in the Mersey Railway Co. With regard to the last named, they had recently sold their debentures at a profit over the price at which they stood on the books. The Clyde Valley Co. had considerably further improved its position within the past year, and there was every indication that before very long it would be in a dividend-paying condition. Its last accounts showed that after paying all expenses, including interest on loans, there was a credit to profit and loss account of over £11,000. With regard to the Traction and Power Securities Co.'s shares, this company, which was largely interested in the Clyde Valley Co. and the Mersey Railway Co., was improving its position through the improvement which had taken place in those two concerns. The Mersey Railway Co. showed year by year a steadily increasing net revenue, which was almost one and a half times the amount required to meet its 4 per cent. perpetual debenture stock interest, this stock being the security in which the Traction Co. was interested. Bills receivable, £6,754; cash at bankers, &c., £73,469; and loan against security, £30,000, amounted altogether to £110,223. These items compared with £198,621 for last year, or a reduction of £88,398. The increase in their stock of material, work in progress, &c., accounted, broadly speaking, for this reduction. As regarded general policy, he might say that the directors continued their endeavours to expand further the existing lines of manufacture, and to add new lines where it seemed that these could be developed advantageously in conjunction with their existing business. The expansion of the company's business in steam turbines had been particularly satisfactory. As was generally known, they altered the design of their turbines about two years ago, when a licence was acquired for manufacturing under the Rateau patents. They had installed, and were at present installing, large numbers of these machines both at home and abroad for important railways and corporations, notably the Metropolitan Railways, the London County Council and the Corporation of Bristol. Those already installed were giving most satisfactory results in steam economy, and were making a reputation for reliability in running, an absolutely necessary feature in electrical equipment. The company's position in this important line of business was stronger than it had ever been, and the directors looked forward to continuous development in this direction. The volume of business during the current year had, so far, been satisfactory. He would not make any prophecy about the rest of the year, but would only say that there was no appearance of any slackening in trade. Before he concluded he must refer to the loss which they had suffered in the departure of their late managing director, Mr. Newcomb Carlton. He left them to take the management of one of the most important concerns in the world—the Western Telegraph Union Co. He knew that it was with the greatest regret that he found himself constrained to relinquish his position with the company and return home to the States at a time when things were looking brighter. He was with the company for some five years all through the bad times, and it was mainly owing to his energy and foresight that they were able to weather the storm so well as they had done.

Mr. E. Goulding, M.P., seconded the motion.

Mr. W. H. Birks said he hoped the holding of the company in the Mersey Railway Co. was debentures.

The Chairman said they had sold their holding in that company, but they were interested in the Traction and Power Securities Co., which was largely interested in the Mersey Co., and their holding was in debentures.

Mr. Birks suggested that instead of putting down the figures in the profit and loss account in one lump sum, it would give the shareholders a better chance of understanding things if they showed the amount of London expenses, the expenses of management, and so on. He also noticed that in the last 11 years there were constant changes on the board, which gave people a bad idea of the position of the company. He hoped their present board would hold together for some time to come. He would also like to know to what extent their works had been occupied. In the early days he took such a sanguine view of the company's prospects, after the rosy speeches of Mr. Westinghouse, that he thought the company were going to have almost a monopoly of the electrical work they were able to do. From that day to this, however, he had never been able to obtain any sort of idea as to whether the works had been occupied to their full capacity. At various times they had had different chops and changes, and that day they were told they were abandoning the manufacture of certain engines, and that the steel foundry was being abandoned. He would also like to know what chance they had of getting their capital back in the future, and also what was the worst which could happen to them in connection with the arbitration award.

The Chairman said the arbitration award was for £84,000, and in addition £16,000 damages were awarded, making it £100,000. Then there were the costs, which they did not know at present. He was afraid if they lost the case it was quite possible the costs might be £20,000; so in that case they would lose £120,000 altogether. It was perfectly true that the works were designed originally on far too lavish a scale, and he doubted whether under the most favourable circumstances it would have been possible to occupy, not the floor space, but the cubic space of the works in the way designed. So far as the occupation of the floor space was concerned, the works manager would tell them that it was pretty fully occupied, except the steel foundry. The steel foundry stood in the books at about £49,000. Had circumstances been more favourable he did not say that it was wrong to have provided the steel foundry. At one time it looked as if it would have been an enormous advantage, and it would be an advantage now if they were able to make their own castings, but on the whole they found they were losing money, and so Mr. Carlton recommended the board to shut it up, and they had done so. They intended taking up the manufacture of large horizontal gas engines but abandoned the idea, as they came to the conclusion, after careful consideration, that there was not sufficient margin of profit to warrant the large

outlay which would be necessary to make this type of apparatus. They still continued the manufacture of large vertical gas engines, for which they were well equipped and which were quite satisfactory in design and efficiency. The board would consider Mr. Birks's suggestion as to the profit and loss account, but if in a concern of that kind they gave too much detail, it might be against their interests in revealing how the results had been arrived at. As to the changes in the board, Mr. Carlton, when he first came to the company, thought it would be better to have more English directors, and that policy had been adopted. Another factor which had operated was that the gentleman who made the financial arrangements some years ago wanted to have a certain amount of control as against the large control held by the American Westinghouse Co., and that accounted for some of the changes.

A SHAREHOLDER asked if the company was advertising in the engineering papers. Perhaps if they advertised more they would get more business.

The CHAIRMAN said they were advertising rather more than before, but it was rather a costly business. Now they were so well established, advertising did not do them so much good as it would a concern just started.

The report was then adopted, and the retiring directors re-elected.

City of Birmingham Tramways Co., Ltd.

MR. E. GARCKE (chairman) took the chair at the ordinary meeting of the above company held at the offices of the Electrical Federation, Kingsway, on Monday.

In moving the adoption of the report, the CHAIRMAN said that on the occasion of the last annual meeting he congratulated the shareholders on the unique position the company occupied in the fact that while it was a tramway company whose lines were gradually passing over to the local authorities, yet its receipts from year to year tended to increase, and its net profits had improved. He was able to again congratulate them on an improved position. The gross receipts were £180,000 as against £172,000 last year, and the net profit, after paying debenture interest and dividend on preference shares, amounted to £44,327, against £38,516 last year. They were again paying 10 per cent. on the ordinary shares, and they were transferring to reserve £36,513. They were now near the end of their prosperity as a tramway company, but of the 18 miles which they were at present working in the City of Birmingham and vicinity, more than half would go out of their hands and pass over to the local authorities on June 30th, and out of the remaining mileage, 6 miles were in Aston, which were being worked by the company without profit. After June 30th, therefore, their profits would undergo a heavy diminution, and their expenses would be relatively large in proportion to the revenue earned. As a matter of fact, he would not be surprised if the expenses for the ensuing half-year were disproportionately large, because obviously they could not maintain in full efficiency an organisation for the purpose of working the lines to the end of June, and then immediately be able to reduce those expenses in proportion to the reduced mileage which they would be running after July 1st. They need not, however, have any misgivings about the future position of the company, for while their position as a tramway company was getting worse, their position as an investment company was becoming distinctly stronger. Last year they received by way of interest on their investments £26,750, as compared with £22,634 in the year before, and the amount of profit which they received from this source, was likely to further increase. In addition to those profits from investments, they would have in the profit and loss account for 1911 full profits for six months' working on the tramways, and they would, after parting with the lines on June 30th, have some miles outside the City, which, although they were short, were very profitable. Therefore, they would see that the company, from the revenue point of view, was likely to be satisfactory, notwithstanding the loss of the lines in the City of Birmingham. They required for the purpose of paying the debenture interest, the preference dividend, and 10 per cent. on the ordinary shares, £28,000 per annum, and they expected to make more than that, not merely this year, but even in subsequent years. Turning to the balance-sheet, they would see that the company's general financial position was a strong one. Their total capital in debentures and shares, added to creditors' and sundry credit balances, amounted altogether to £617,707, and against that they had on the other side investments in cash and due to them £660,823, or £43,000 more than their total liabilities. In addition, they had further assets to realise. He could not at the moment tell them what further sums would be realised from the remaining assets, and they must be satisfied by his telling them that it was a substantial amount. The directors would have to seriously consider whether they could not make some arrangement with the trustees for the debenture-holders to give the company some relief in regard to the obligations under the trust deeds. As they were aware, they had already paid to the trustees for the debenture-holders more than sufficient to pay off the whole of the debentures, but notwithstanding that, they were bound under the trust deed to pay to the trustees £10,000 per annum to provide a further sinking fund, which was not required. The debentures were not redeemable till 1917, and they were to bearer, and it was very difficult to bring the holders together for the purpose of considering any scheme of readjustment, but they would have to see what could be done, for obviously it was not right that the company, after having paid sufficient to discharge all liabilities, should be compelled to go on paying further sums which the trustees were precluded from investing other than in trustee securities yielding a very moderate interest, as against the more satisfactory interest which the directors were able to earn. There were other matters which the directors would have to take into consideration. Their total capital expenditure, according to the balance-sheet, was £457,125, and at the end of the year the expenditure would not be fully represented by tangible assets. That did not matter, because they had a reserve amounting to £465,932. It would be for the directors, however, to consider whether it would be advisable to make any adjustment between the capital account and the reserve fund He could not make any pronouncement on the subject for the moment, but it was quite probable that the next balance-sheet would in some respects necessarily contain important alterations. Whatever they were, however, the shareholders could be quite easy that notwithstanding the exceptional difficulties the company had had to overcome, its capital was intact, and there was a good prospect of their being able to maintain the 10 per cent. dividend on the ordinary shares.

MR. G. C. CUNNINGHAM seconded the motion, and after Mr. Lyons had congratulated the directors on their able management of the company's affairs, the report was adopted.

Cork Electric Tramways and Lighting Co., Ltd.

MR. A. R. MONKS presided on Wednesday last week over the annual meeting of this company, held at the offices, 83, Cannon Street, E.C.

In moving the adoption of the report, the CHAIRMAN said that, owing to the increased popularity of electric light due to the great economy attainable by the use of metallic-filament lamps there had been a substantial increase in the number of consumers. The additional consumers obtained last year represented a total gain of 300 KW., which, he thought, was remarkable, in view of the fact that the company had now been operating some 13 years, and tended to show the unassailable position which electric light and motive power had now attained. As regarded the supply of electricity for power, the demand showed no falling off, and this was not to be wondered at in view of the immense superiority from many points of electricity over any other form of power. The lighting and power revenue for the past year showed an increase of £1,300 over the previous year, and the additional connections obtained during 1910, and further connections obtained since January 1st, should result in a further improvement for the current year. The District Council lighting, which he referred to last year, had been completed, and the company had received congratulatory remarks from a number of residents on the steadiness and maintenance of the candle-power of the light. The District Council were evidently very satisfied, and had increased the number of public lamps originally contemplated. They had recently installed, owing to increased demands, an additional 1,000-H.P. boiler; this boiler being fitted with a mechanical stoker and superheater, it was hoped that increased efficiency would be obtained and that the risk of any stoppage of the supply of electricity to the town would be additionally safeguarded should there be any further disturbance in the labour market. The traffic receipts were satisfactory. There was an increase in the takings of £2,054, the revenue per car-mile and average fare were 6·80d. and 1·07d. respectively, as against 6·51d. and 1·05d. for 1909. The total revenue from all sources showed an increase of £3,337, and as there was only an increase of £576 in the expenses, the gross profits showed an improvement of £2,761. The increase in expenses was in connection with the traction side of their business, and was due to heavier maintenance charges for track and rolling stock. They rebuilt several car bodies, and intended to continue the renewal of their cars, as required, out of revenue. They had written £1,772 off house services, wiring consumers' premises, plant on loan, &c., and had transferred £5,000 to reserve for depreciation, as against £3,500 for 1909, so that, in addition to meeting renewals out of revenue, they had transferred a larger amount to the depreciation fund. The balance available allowed of an increase in the dividend on the ordinary shares from 3 per cent. to 4 per cent., and gave them £1,319 to carry forward, which was £800 more than they brought into the accounts. He thought they would agree that these results were very satisfactory.

MR. LEWIS seconded the motion, which was adopted without discussion.

Colombo Electric Tramways and Lighting Co., Ltd.

THE ninth annual general meeting of this company took place at 11, St. Bene't Place, E.C., on Wednesday last week. The proceedings were private, but the following report was adopted:—The accounts now presented for the year ending December 31st, 1910, show a total net profit in Ceylon for the year, after deducting all current expenses, amounting to £28,659. During the year, 2,136,174 units were generated, as against 2,019,639 for the previous year, the cost per unit being slightly less. The receipts from this source show marked improvement. The passengers carried numbered 7,953,850, as against 7,109,939 for the previous year. The lighting branch of the company's business continues to show satisfactory progress. The total available profit, after providing for debenture interest and all expenses, and including the balance brought forward, amounts to £22,478. Out of this sum the directors have transferred £8,300 to general reserve and renewal fund, which has been dealt with by writing off £4,000 from the track renewal account, and £1,300 from the mains and plant account, leaving the general reserve and renewal fund at £20,000. The directors propose to pay a dividend of 8 per cent. on the share capital, free of income-tax, amounting to £10,467, leaving a balance of £3,711 to carry forward.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	April 26	2,721	+ 357	47	65,306	+ 1,988	..	..
Ayr	„ 29	546	+ 84	50	14,286	+ 438	8	..
Bath	„ 29	2,047	+ 592	17	11,818	— 138	..	..
Belfast	„ 28	9,377	+1,726	4	17,648	+ 2,577	37	..
Birkenhead	„ 30	2,217	+ 189	4	4,616	+ 155	13·7	..
Birmingham Corp.	„ 22	15,315	+1,999	3	23,727	+ 1,961	56·46	..
†Blackburn	„ 19	1,923	+ 976	8⅔	4,433	+ 475	14·6	..
†Blackpool Corp.	„ 20	2,526	+2,019	..	3,578	+ 2,004	..	..
Blackpool-Fleetw'd	„ 29	1,410	+ 808	17	5,628	+ 521	..	..
Bolton	„ 23	5,701	+1,148	4	8,768	+ 1,110	25	..
Bournemouth	„ 26	4,277	+1,027	3	6,632	+ 865	21·95	..
Bradford	„ 22	12,049	+2,569	3	18,077	+ 2,475	54·81	..
Brighton	„ 30	2,032	+ 415	4⅔	4,032	+ 425	9·5	..
Bristol	„ 28	13,641	+2,639	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 21	424	— 15	16	3,345	— 50	3·65	..
Barnsley	„ 21	429	+ 87	„	2,791	+ 99	..	..
Barrow	„ 21	608	+ 160	„	3,794	+ 209	5·37	..
Cavehill	„ 21	255	+ 105	„	1,119	— 38	..	..
Devonport	„ 21	1,055	+ 239	„	6,904	+ 350	8·85	..
Gateshead	„ 21	2,151	+ 313	„	15,836	+ 819	11·25	..
Gravesend	„ 21	495	+ 122	„	2,935	— 32	6·5	..
Greenock	„ 21	1,454	+ 229	„	9,818	+ 1,410	7·25	..
Hartlepool	„ 21	554	+ 134	„	3,474	+ 209	6·72	..
Kidderminster	„ 21	281	+ 108	„	1,423	+ 55	..	..
‡Leamington	„ 21	372	+ 93	„	2,174	— 121	..	..
Merthyr	„ 21	520	+ 153	„	3,048	+ 48	2·9	..
Metropolitan	„ 21	20,260	+6,392	„	125,861	+18,087	22	..
Middleton	„ 21	861	+ 310	„	4,745	+ 868	8·5	..
Mid. Joint Com'tee	„ 21	13,850	+2,704	„	91,843	+ 5,468	..	..
Oldham—Ashton	„ 21	1,466	+ 441	„	8,616	+ 307	9·13	..
Peterborough	„ 21	297	+ 92	„	1,608	+ 108	5·31	..
Potteries	„ 21	4,126	+ 507	„	30,052	+ 3,008	29	..
Rothesay	„ 21	406	+ 230	„	1,035	+ 107	2·75	..
Southport	„ 21	723	+ 221	„	3,848	+ 16	8·17	..
S. Metropolitan	„ 21	2,118	+ 604	„	11,459	— 95	..	..
Swansea	„ 21	2,456	+ 440	„	10,705	+ 1,228	12·5	..
Tynemouth	„ 21	503	+ 199	„	2,531	+ 78	3·75	..
Weston-s-Mare	„ 21	264	+ 146	„	526	— 133	3	..
‡Worcester	„ 21	700	+ 204	„	3,863	+ 42	5·75	..
Wrexham	„ 21	252	+ 80	„	1,476	+ 12	..	..
Yorks. Wool. Dist.	„ 21	2,315	+ 411	„	15,840	+ 1,152	17	..
Miscellaneous	„ 21	496	+ 100	„	3,124	+ 89	..	..
Burnley	„ 29	2,554	+ 209	..	..	..	11·13	1
Burton-on-Trent	„ 30	563	+ 58	4	1,142	+ 63	6·62	..
Bury	„ 30	2,383	+ 186	4⅔	5,530	+ 618	22·5	..
Cardiff	„ 22	4,972	+ 779	3	7,521	+ 675	..	..
Chatham and Dist.	„ 27	1,978	+ 497	17	12,932	+ 27	14·98	..
Cork	„ 27	1,085	+ 122	17	7,385	— 45	9·89	..
Croydon	„ 21	4,043	+ 874	..	5,505	+ 636	11·25	..
†Darlington	„ 15	201	+ 18	3	588	+ 30	..	..
Darwen	„ 28	540	+ 64	4	1,079	+ 159	4·36	..
Dover	„ 22	526	+ 160	3	754	+ 145	4·75	..
Dublin	„ 28	12,163	+1,430	..	86,112	+ 829	54·2	..
Dundee	„ 26	2,318	+ 58	49⅔	68,371	+ 270	15	..
East Ham	„ 29	2,189	+ 243	4⅔	4,383	+ 391	7·87	..
†Exeter	„ 28	305	+ 15	4	1,284	+ 74	5·5	..
Glasgow	„ 29	36,983	+1,274	..	853,948	+45,712	97·75	2·12
Hastings	„ 27	2,565	+ 825	..	..	..	..	..
Huddersfield	..	..	..	..	..	..	..	..
Hull	„ 29	5,817	+ 659	4	12,091	+ 870	14·5	..
Ilkeston	„ 27	285	+ 51	4	525	+ 76	..	..
Ipswich	„ 29	897	+ 207	4	1,741	+ 306	10·5	..
Kilmarnock	„ 29	803	+ 23	50	7,521	+ 300	4·25	..
Lancashire United	„ 26	3,411	+1,011	17	21,059	+ 496	39	..
Leeds	„ 29	15,337	+2,001	4	31,261	+ 4,183	57	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 29	1,179	+ 61	49⅔	29,397	+ 89	8·72	..
Liverpool	„ 23	22,249	+1,726	16	174,901	+ 5,571	116	6·5
‡L.C.C.	„ 19	89,104	+9,172	..	118,643	+10,507	138·2	6
London United	„ 29	15,848	+3,696	..	95,098	+ 5·8	..	..
Lowestoft	„ 29	343	+ 84	30	4,605	+ 164	3·5	..
†Manchester	„ 24	16,743	+1,949	3	51,500	+ 6,206	183	..
Newcastle	„ 29	8,650	+1,165	..	17,617	+ 1,566	14·5	..
Newport	„ 22	1,580	+ 264	3	2,342	+ 234	14·5	..
Oldham	„ 30	3,958	+ 412	5	10,318	+ 360	23·5	·5
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 29	4,783	+ 750	4	6,479	— 1,240	15·75	..
Preston	„ 26	1,593	+ 282	4	2,922	+ 262	..	..
Salford	„ 24	10,302	+1,363	3⅔	16,765	+ 1,818	..	..
Sheffield	May 2	13,154	+1,484	5	32,441	+ 1,697	40	..
Southampton	April 26	2,423	+ 425	4	4,189	+ 472	..	..
Southend-on-Sea	„ 26	1,415	+ 482	4	2,083	+ 419	..	..
South Shields	„ 29	1,330	+ 227	4	2,548	+ 503	..	..
Swindon	„ 26	386	+ 80	4	565	+ 78	..	..
Tyneside	„ 26	1,287	+ 541	17	6,950	+ 490	..	..
Wallasey	„ 29	2,290	+ 638	4⅓	4,466	+ 864	..	..
Walthamstow	„ 29	1,688	+ 439	4	3,232	+ 688	9	..
West Ham	„ 20	5,825	+1,239	3	8,185	+ 1,346	15·25	..
Wolverhampton	„ 26	2,149	+ 458	4	3,650	+ 558	14·25	..
Cen. London Rly.	„ 29	9,686	—1,462	17	89,658	— 4,048	6·32	..
City & S. Lon. Rly.	„ 30	5,780	+ 283	17	58,277	+ 2,274	7·26	..
Dublin-Lucan Rly.	„ 28	314	+ 52	17	1,925	— 37	7	..
G.N. and City Rly.	„ 29	2,980	+ 55	17	26,051	+ 1,059	3·5	..
L'pool Overh'd Rly.	„ 30	3,014	+ 337	..	23,758	+ 1,602	6·8	4·8
Llandudno-Col. Bay	„ 28	646	+ 318	21⅓	3,119	+ 83	..	..
London Elec. Ry. Co.	„ 29	97,335	+1,545	17	239,945	+13,400	21·25	..
Mersey Railway	„ 29	4,800	+ 160	17	84,929	+ 995	4·5	..
Metropolitan Rly.	„ 30	34,495	+ 807	..	287,346	+ 7,658	24·5	..
Met. District Rly.	„ 29	23,212	+1,059	17	199,566	+14,675	24	..
Anglo-Argentine	„ 29	98,627	+7,904	..	842,694	+101,415	..	..
§Auckland	Mar.	16,494	+1,311	..	159,062	+16,291	28·8	·6
Bombay (B.E.S.T.)	„ 8	5,721	+ 457	5	14,084	+ 557	..	..
Brisbane	Mar.	20,056	+2,066	12	56,891	+ 6,061	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	April 29	7,902	+ 855	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Mar.	3,639	..	..	9,851	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 15	1,725	+ 406	..	7,550	+ 874	..	..
§Montevideo	Mar.	28,493	+3,102	20	140,920	+13,478	..	..
Perth (W.A.)	April 28	3,109	+ 505	..	28,104	+ 1,345	29	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

THE May Day holiday in the Stock Exchange led to a certain amount of closing up of books in advance by people, especially speculators who did not care to go away for a long week-end with a fair amount of commitments on their books. In addition, there has been a little financial trouble in the House itself, and a good deal of anxiety on the part of the weaker element of Home Railway bulls. These factors, taken in conjunction with the foreign political unrest, tended to produce dull markets, but prices responded gamely to a little buying to-day (Tuesday), and there was a general recovery.

Again it is the Home Railway market which dominates most of the interest in the Stock Exchange. Prices are violently moved, as first the bull party and then the bear gains the upper hand, and the centre of the speculation is Brighton Deferred. The price got down to 107¼ before rallying to 110, and there has been a tremendous amount of dealing in this stock.

Next to Brighton Deferred, perhaps the most interesting stock is East London Ordinary, with its trio of junior Debenture issues. It is at last announced that the guaranteeing companies are about to take electrification seriously in hand; and on this consummation of long-deferred hopes, the price of the Ordinary rose to 7⅞, while the Debentures put on several points. The subsequent decline took the Ordinary back to 7⅝, but again it revived, and even now, for the buyer who cares for the long shot, this stock and the Fourth Debenture look good to lock up.

Metropolitan Consolidated slumped to 50¾, some five points lower than it touched in the recent boomlet, but hardened up again to 52½. Here, again, the movements are being dictated by gambling transactions rather than investment dealings. Districts are somewhat overlooked, and, after being weak with the rest of the market, braced up substantially to 33½, showing on balance a rise of 1½. Central Londons have retained their prices, and City and South London has not altered.

The feature in the Telegraph market is the activity in Anglo-American Telegraph stocks. Although prices have not moved to any noticeable extent on balance, the Deferred has been flat at 28, from which it recovered to 28⅞, but lost ¼ again. There is a great deal of talk as to the precise position of the negotiations as they stand at present with the Western Union Company. The price of the latter company's 4 per cent. Redeemable Bonds is 104½, while the 4½ per cent. 50-year Gold Bonds stand just under par. The position, after all, seems to be still somewhat confused, but so far as can be seen, the Anglo Company holds the picture cards, and can force the hand of the Americans if it chooses to do so. West India and Panama Telegraphs have given way a little, but the Preferences retain their prices. The Eastern group is steady, without particular change.

Of the Telephone issues, there has been a little more speculation in National Telephone Deferred, and in the Third Preference shares, but the prices are very much the same as they were a week ago. Estimates as to what the Deferred stock will be paid off at are again becoming fashionable, and the wildest figure we have heard mentioned up to the present is 175 per cent. Oriental Telephone Ordinary and Preference are *ex* dividend, and so are the Monte Video Ordinary and Preference, the deductions making little difference to the quotations.

Among the Mexican group the news which has come from that country is rather more pacific, and therefore promoted a better tendency in prices. Mexico Trams First Bonds hardened to 97 and the Seconds to 102. Rio Trams are weaker at 109½, but the First Bonds at 102½ and the Seconds at 95½ are very firm. There has been a certain amount of inquiry for these from Continental capitalists, and it is said that a Swiss group is about to take a hand in the market.

Electricity Supply shares are very quiet. The lesser-priced issues retain the substantial rises which fell to them last week; for example, Edmundsons, London Electric, and Urban shares of both classes are all very steady at the advances which they registered then. London Electric Ordinary shares have changed hands as high as 40s. 3d., and Edmundson's Preference have been bought at 3¾. There is a fair demand for the Debentures of the best class. There are several new appeals to be made for capital in connection with Canadian companies which will probably be out during this month.

The Rubber market has been giving a good deal of trouble to the bears who sold short on the very depressed conditions that prevailed a week ago. The commodity had a sudden rise from 4s. 8d. to 5s. 5d., accompanied by various rumours as to what the Brazilian Syndicate intended to do. With this the leading shares enjoyed a swift recovery, but there is a good deal of nervousness still felt regarding a market in which prices are so much dependent upon the affairs of Mincing Lane manipulators, to say nothing of the Brazilian Syndicate.

It will be observed that the price-lists following have been greatly enlarged, by the addition of many more securities to the number hitherto quoted. The only excuse for drawing attention to a change so manifest is that in such an alteration, various mistakes have an uncanny knack of eluding whatever care is bestowed upon the not inconsiderable work of preparation. This is accordingly a little apologia for such errors as the change almost necessitates, and an expression of hope that future lists will be as correct as they can be made in the interests of those of our readers whom we desire the better to serve.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations May 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8¼ — 8⅝	..	6 5 9
Do. 4½ % Pref.	10	4½	4½	9⅜ — 9⅝	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	102 —104	+1	4 6 7
Brompton & Kensington, Ord.	5	10	10	7⅝ — 7⅞	..	6 11 2
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 7⅞	..	4 11 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	99 —103	..	3 17 8
Charing Cross & Strand	5	5	5	4 — 4⅛	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Chelsea, Ord.	5	4†	5	4 — 4⅛	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	100 —102	..	4 8 3
City of London, Ord.	10	7	7	11⅝ — 12	..	5 16 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham E.P., Ord.	5	Nil	Nil	1⅝ — 2	..	Nil
Do. 5 % Pref.	5	5	5	2⅝ — 3	..	8 6 8
Do. 5 % First Mort. Deb.	Stock	5	5	92 — 94	..	5 6 5
County of London, Ord.	10	5	5	7⅜ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	10⅞ — 11⅜	..	5 7 5
Do. 4½ % Deb.	Stock	4½	4½	109½—111½	..	4 0 9
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	—2	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — 1	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3⅜ — 3⅞	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5½	6	4½ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4½ — 5⅛	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6⅝ — 7⅛	..	6 13 4
Kensington & Knightsbridge, Ord	5	8	9	7 — 7¾	..	6 2 0
Do. 4 % Deb.	Stock	4	4	93 — 95	..	4 4 8
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1¾ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4½ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	5	5	3⅞ — 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¼	+ ⅛	4 16 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 89	..	3 18 8
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97 — 99	..	4 10 11
Newcastle-on-Tyne	5	4	4	3¾ — 4⅛	..	4 14 2
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4¼	— ⅛	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	95 — 97	..	5 3 1
Notting Hill	10	7½	8	12 — 12¾	..	6 5 6
Oxford	5	7	7½	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9⅛	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	3 — 3¼	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	101 —104	..	4 16 2
South Metropolitan, Ord.	1	Nil	Nil	⅞ — 1	..	Nil
Do. 7 % Pref.	1	7	7	1⅞ — 1 13/16	..	5 17 [illegible]
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98	..	4 11 10
Urban, Ord.	5	5	3½	2 — 1¼	..	15 0 0
Do. 5 % Cum. Pref.	5	5	3½	2¼ — 3	+ ⅛	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅝	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8	7†	6⅜ — 7¼	..	5 10 4
Do. 5 % Pref.	5	5	5	4¼ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	95½ — 97½	..	5 2 7
Canadian Gen. El. Com.	$100	6	6	114 —117	—3	5 2 7
Do. 7 % Pref.	$100	7	7	119 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	..	6	13/16 — 15/16	..	6 8 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	96 — 98	+1	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85 — 87	+2	5 15 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/32	..	..
Do. 6 % Pref.	1	6	6	13/32 — 15/32	— 1/32	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	Nil	3 — 3½	..	..
Melbourne, 6 % Pref.	100	Nil	Nil	36 — 41	..	..
Do. 5 % 1st Mort. Deb.	100	5	5	94 — 96	+ ½	5 4 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½ — 90½	+ ½	5 11 1
Mexican Lt. & Power, Common	$100	4	4†	86 — 88	..	4 10 11
Do. 7 % Cum. Pref.	$100	7	7	107½—109½	..	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 96	..	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	..	8	153 —156	..	5 2 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	71 — 73	—2	6 17 0
River Plate, Ord.	Stock	9	10	228 —238	..	4 4 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	110 —117	..	5 2 7
Do. 5 % Deb. Stock	Do.	5	5	104 —106	+1	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	115 —118	+1	4 4 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108½—110½	+1	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 4 11
Toronto Power, 4½ % Deb.	Do.	4½	4½	101 —103	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	+1	5 7 6
Victoria Falls Power, Pref.	1	Nil	Nil	1⅛ — 1	— 1/32	Nil
Do. (new)	1	..	Nil	⅞ — 15/16	— 3/32	Nil
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	107 —110	+2	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7¼ — 7⅞	+ ¼	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	+1	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	150 —152	..	5 5 3
Do. Collat. Trust	$1000	4	4	93⅜ — 95½	+ ½	4 4 3
Anglo-American Telegraph	Stock	3⅜	3⅜	71 — 73	..	5 2 9
Do. 6 % Pref.	Do.	6	6	116 —117	+ ½	5 2 7
Do. Def.	Do.	25/-	30/-	28 — 28½	..	5 13 8
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	+2	5 6 2
Chili Telephone	5	8	..	7 1/16 — 7 5/16	..	5 11 11
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	88 — 90	..	4 8 11
Cuba Telegraph	10	6	6	9⅜ — 10⅛	+ ⅛	5 14 3
Do. 10 % Pref.	10	10	10	17½ — 18½	+ ½	5 8 1
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8¾	+ ⅛	5 14 3
Do. 4½ % Debs.	50	4½	4½	100½—102½	+ ½	4 8 8
Direct United States Cable	10	4	5	7⅜ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	100 —102	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	— ⅛	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	100¾—102½	—1⅛	3 18 1
Eastern Extension	10	7	7	13⅜ — 13⅝	+ ⅛	5 0 9
Do. 4 % Deb.	Stock	4	4	100 —102	..	3 18 5
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½—101½	—1	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅜ — 11⅛	..	5 9 4
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 9
Great Northern Telegraph	10	18	18	31½ — 32½	—1½	5 10 0
Indo-European Telegraph	25	13	13	59 — 61	..	5 12 0
Mackay Companies Common	$100	4½	5	93 — 96	..	5 3 1
Do. 4 % Cum. Pref.	$100	4	4	78 — 80	..	5 0 0
Marconi's Wireless Telegraph	1	Nil	Nil	1⅛ — 1¼	..	Nil.
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	— 1/16	6 0 0
Do. 5 % Pref.	1	5	5	⅞ — 1	— 3/32	5 10 4
National Telephone, Pref.	Stock	6	6	104½—105½	..	5 14 0
Do. Def.	Do.	6	6	135 —137	—1	4 7 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10⅛ — 11	..	5 9 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 6 1/16	..	4 2 8
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 10 0
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 2
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98½ — 99½	—2	4 9 1
Oriental Telep. and Elec.	1	8	6†	1⅝ — 1¾	— 1/16	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1 3/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	— ½	4 9 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	100 —102	..	3 18 5
Reuter's	8	5	5	7⅞ — 8¼	..	4 15 3
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 9 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	+ ½	4 8 8
United River Plate Telephone	5	8	6†	7⅛ — 7⅜	..	5 3 3
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	+ ⅛	4 6 11
West Coast of America	2½	2½	..	1⅜ — 1½	..	..
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	99½—101½	..	3 18 10
West India and Panama Teleg.	10	Nil	½	2⅜ — 2 13/16	— ⅛	1 16 4
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	14½	..	9⅝ — 9⅞	+ ⅛	6 1 6
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	7	13¾ — 14	..	4 19 1
Do. 4 % Deb.	Stock	4	4	101 —103	—2	3 15 10
Western Union Tel., 4 % Bnds. A	$1000	4	4	103 —106	..	3 15 6
Do. 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 8 3

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations May 2nd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 1/2	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1/8 — 1/4	— 1/8	Nil
Do. 6 % Pref.	10	8	..	4½ — 5	— 1/8	Nil
Do. 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 82	—2	5 9 9
Central London Railway, Ord.	100	3	3*	74 — 76	..	3 18 11
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	64 — 66	..	3 0 7
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1⅜	1½	34⅛ — 35½	..	4 4 6
Do. 5 % Pref., 1891	100	5	5	109 —111	+1	4 10 1
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	101 —104	..	4 16 2
Do. Do. 1903	100	5	5	101 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	100 —102	—1	3 18 5
Dublin United Trams, 6 % Pref.	10	6	6	12⅜ — 13⅛	..	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅜ — 1⅝	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1⅜ — 2	+ ⅛	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	+1	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1¼	2½	2 — 2⅜	..	5 5 3
Do. 4 % Deb.	100	4	4	79 — 84	..	4 15 3
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	Nil	2⅜ — 3⅛	..	Nil
Do. 4 % Deb.	100	4	4	74 — 77	..	5 3 11
Manx Elec. Railway, 4½ % Deb.	100	4½	4½	84 — 89	..	5 1 2
Metropolitan Railway Consol.	100	1	1⅜	52½ — 52⅝	+1¼	2 12 2
Do. Surplus Lands	100	2⅜	2½	66 — 68	..	4 0 11
Do. 3½ % Deb.	100	3½	3½	93 — 95	..	3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91	..	3 16 11
Metropolitan District Ord.	100	Nil	Nil	33¼ — 33⅝	+2⅛	Nil
Do. 6 % Deb.	100	6	6	148 —150	..	4 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	—2	3 18 5
Do. 4½ % First Pref.	100	..	3⅛	88 — 90	..	3 12 3
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5	5½	1/16 — 1/8	..	5 17 4
Do. Def.	1	Nil	Nil	3/16 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	99½ —101½	..	4 18 6
Potteries, Ord.	1	2	..	1/8 — 3/16	..	..
Do. 5 % Pref.	1	5	5	1/2 — 23/32	..	6 19 2
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	3	..	1/8 — 1/16	— 1/16	..
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Underground Elec. Railways 5 % Prior Lien	..	5	5	100 —101	—2	4 19 0
Do. 4½ % Bonds	100	4⅓	4⅓	97 — 99	..	4 10 11
Do. 6 % Income	100	Nil	10/-	57 — 59	..	0 17 3
Do. Power House Debs.	100	..	4	99 —101	..	3 19 3
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛ — 2⅜	..	..
Do. 4½ % Deb.	100	4½	4½	84 — 87	+1	5 3 6

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛ — 5 5/16	..	4 14 1
Do. 2nd Pref.	5	5	5	4⅛ — 5⅛	..	4 17 7
Do. 4 % Deb.	100	4	4	92 — 93½	..	4 5 7
Do. 4½ % Deb.	100	4½	4½	98⅜ —100½	+ ⅛	4 9 7
Do. 5 % Deb.	100	5	5	102 —104	+ ⅛	4 16 2
Auckland Trams, 5 % Deb.	100	5	5	104⅜ —106⅛	..	4 13 11
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅛	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96⅜ — 98⅛	+ ⅛	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	— 3/32	5 1 0
Brisbane Trams Invt., Ord.	5	8½	8†	6⅛ — 7	— ⅛	6 1 5
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	146 —150	—4	5 6 8
Do. Pref. Ord.	100	6	6	124 —127	..	4 14 6
Do. 5 % Pref.	100	5	5	107⅞ —110½	..	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	100⅛ —102½	..	4 7 10
Calcutta Trams, Ord.	5	4½	5	5¼ — 5⅝	— ⅛	4 6 11
Do. 5 % Pref.	5	5	5	5¼ — 5⅝	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
Cape Electric Trams	1	Nil	Nil	7/16 — 9/16	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5 7/8	..	4 5 1
Do. 4 % Deb.	100	5	5	98 —101	..	4 19 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —98	—2	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99½ —101½	..	4 18 6
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	94 — 97	..	5 3 1
Do. 6 % B Deb.	100	6	5	66 — 70	..	7 2 10
La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	13/16 — 15/16	..	6 8 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	98 —102	..	4 18 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	92½ — 94½	..	5 5 10
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 —101	..	4 19 0
Mexico Trams Com.	$100	6	7	124 —126	+1	5 11 1
Do. Gen. Con. 5 % Bonds	..	5	5	97 — 98	+ ⅛	5 2 0
Do. 6 % Bonds	100	6	6	102 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 11/16 — 7 13/16	..	6 6 0
Do. 6 % Pref.	5	6	6	5⅜ — 5¾	..	5 2 2
Do. 5 % 1st Deb.	100	5	5	102 —104	+ ⅛	4 16 2
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	11/16 — 13/16	..	2 13 4
Do. 5 % 1st. Deb.	100	5	5	104 —106	..	4 14 4
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	99 —102	..	4 8 3
Rio de Janeiro Trams	$100	2	5	109 —110	—1	4 10 11
Do. 1st Mort. 5 % Bonds	..	5	5	102 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	95 — 96	+ ⅛	5 4 2
Sao Paulo Tram, Lt. and P.	$100	10	10	168 —170	..	5 17 8
Do. 5 % 1st Deb.	$500	5	5	103¼ —104½	..	4 15 11
Singapore Trams, 5 % Deb.	100	5	5	82 — 86	..	5 16 3
Southern El. Tr. B.A., 5 % Deb.	..	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	6†	6 — 6⅜	..	5 7 8
Do. 6 % Pref.	5	6	5	5 5/8 — 5 11/16	..	4 9 11
Do. 5 % 1st Deb.	100	5	6	101 —104	—2	5 15 5
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	..	17/32 — 21/32	..	..
Do. 6 % Pref.	1	12	9	23/32 — 25/32	..	7 2 0
Babcock & Wilcox	1	24	20†	5⅛ — 5⅜	— ¼	4 3 6
Do. Pref.	1	6	6	1⅜ — 1⅝	..	4 0 0
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	5⅜ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	+1	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	15/32 — 17/32	+ 3/32	Nil
Do. Deb.	100	4	4	60 — 63	+1	5 16 6
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	Nil	1/16 — 11/16	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	1/16 — 5/16	..	Nil
Do. 7 % Pref.	2	Nil	Nil	3/8 — 1/2	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	41 — 46	..	9 15 7
Callender's Cable	5	15	10†	9⅜ — 9⅝	..	7 13 5
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
Castner-Kellner	1	17½	..	3 7/8 — 3 15/16	..	4 18 3
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	Nil	3/8 — 7/8	..	Nil
Do. Deb.	100	5	5	70 — 80	..	6 5 0
Dick, Kerr	1	5	6	7/8 — 1	..	6 0 0
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	Nil	3/8 — 5/8	..	Nil
Do. fully paid	5	Nil	Nil	1⅛ — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	69 — 73	..	5 9 7
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	3/4 — 1	..	Nil
Do. Pref.	2	7	7	1⅜ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	10⅛ — 10⅜	..	6 10 3
Do. Deb.	100	5	5	102 —103⅛	..	4 16 7
General Electric, Pref.	10	5	5	8⅛ — 8⅜	..	5 14 3
Do. Deb.	100	4	4	83 — 88	..	4 10 11
Henley's, Ord.	5	15	15	12½ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	11⅝ — 5 5/16	..	4 6 9
Do. Deb.	100	4½	4½	108 —110	..	4 1 10
India-Rubber, G. & T.	10	10	10	16¼ — 17	..	5 17 8
Do. Pref.	10	5	5	10⅛ — 10⅝	..	4 14 1
Telegraph Construction	12	17½	20	36½ — 38½	+ ½	6 5 0
Do. Deb.	100	4	4	100 —102	..	3 18 5
Willans & Robinson	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. Pref.	5	3	Nil	⅜ — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

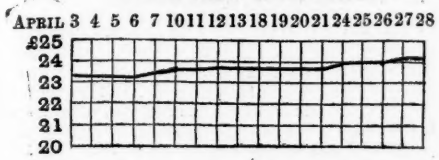
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

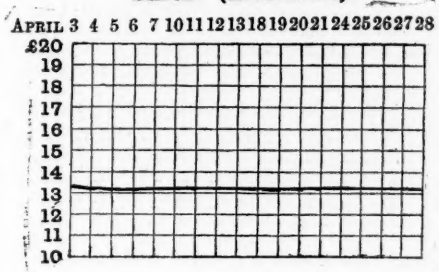
METAL MARKET.

Fluctuations in April.

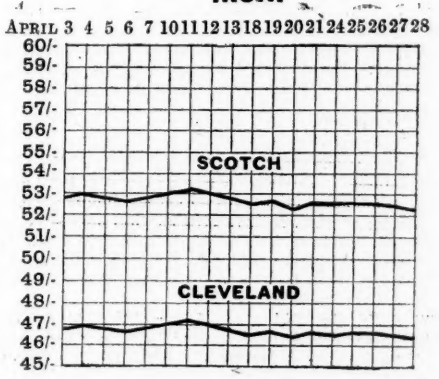
SPELTER (G.O.B's.).



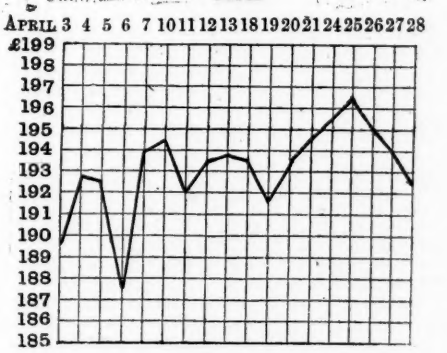
LEAD (ENGLISH).



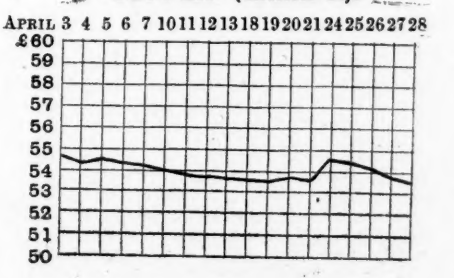
IRON.



TIN.



COPPER (G.M.B's.).



Burnley Tramways.—The T.C. has decided to proceed with the extension of the tramways to Briercliffe. With cars and the extension of the depôt, the estimated cost is £14,650.

FOREIGN COMPARED WITH HOME INDUSTRIAL FINANCE.

By L. JOSEPH.

(*Concluded from page* 672.)

As you are aware, the termination of the Franco-German war of 1871, and the inflow of the war indemnity, amounting to £200,000,000, gave a great stimulus to German enterprise. Trade and industry became extremely active; railways were largely extended; the construction of new lines was rushed on a large scale. A number of new banks, classified as "credit mobilier," were established largely in the provinces. In 1871 a concession was granted for the erection of the Deutsche Bank, in Berlin, with a capital of £750,000. At that time a Government concession was still required for opening banks, but this has since been abandoned.

However, the spirit of enterprise had soon transgressed the limits of solid developments. In the year 1872 the total capital of the credit institutions already amounted to about £55,000,000 sterling. A severe reaction set in, resulting in 1873 in a crisis, the result of which was that not less than 73 banks, with a capital of 21½ millions sterling, were forced into liquidation within the following six years. In 1875 the Imperial Reichsbank, succeeding the Prussian Bank, a Government institution, was founded. The Reichsbank is also under the control of the Government, though its capital is privately held. It has the privilege of Note Issue, and its constitution and functions are, upon the whole, identical with those of the Bank of England, with that distinction, however, that its power of issuing notes is elastic to a certain degree, whilst its regulations in respect of discounting bills are not so discretionary. In other words, the Reichsbank is compelled to discount regular bills on certain conditions, whilst the Bank of England can refuse to do so. The Reichsbank is managed by the President, in conjunction with a committee, the members of which are appointed for life, and controlled by a board of five members, the president of which is the Imperial Chancellor. The interests of shareholders are represented by a committee of 15 members and 13 alternates, elected by the general meeting, who are, as a rule, leading bankers and merchants, and whose advice is given due consideration in the monthly meetings, though they have no actual power with regard to the direction of the affairs of the bank, &c. A deputation of three from the midst of the shareholders' committee keeps in touch with the operations of the Reichsbank, by way of inspection and otherwise. The development of the Reichsbank, its able policy and operations, its co-operation with the credit banks, have undoubtedly exercised a beneficial influence upon the whole industrial and banking system in Germany.

You must bear in mind that in Germany and on the Continent generally, it is a recognised privilege of the banks, it is their *raison d'être*, to cultivate all branches of banking transactions—receiving deposits, discounting bills, buying and selling exchange, changing foreign moneys, making advances on securities and merchandise, granting credits, buying and selling securities on commission, underwriting and issuing loans, administrating fortunes, guaranteeing contracts and so forth. By force of circumstances, German banks have to devote their attention to all these transactions. German wealth has not yet assumed such proportions—at any rate the loanable capital has not yet increased to such an extent—as to encourage the establishment of deposit banks pure and simple. Any number of proposals which have been submitted during the last 20 years or more have been dismissed, because there really seems no need for division of work and function as in England. Besides, neither the German capitalists nor the small saving classes are used to leave their money on deposit for any length of time; they are much more eager to invest it in security. Moreover, in view of the recognised activities of banks, the public at large does not find anything disquieting or unsafe in the manner in which banks seek employment for funds entrusted to them. Confidence in the administration of the bank, and the integrity and responsibility of the board of directors, who are mostly composed of wealthy and high-class men, and in the ability of the management, has, in the course of years, been so fortified that only a serious catastrophe could seriously shake it. Can such a calamity happen? It seems almost impossible, considering the enormous amount of share capital and reserves of the big banks, of the solidarity of interests amongst them, the efficient control exercised by the board of directors, and the influence and assistance of the Reichsbank in the last resort.

You might remind me of the Leipziger Bank or the Niederdeutsche Bank failures, the former in 1901 and the latter only last year. The Leipziger Bank failure, certainly a serious matter, was due to the lack of supervision by the board, who placed implicit confidence in its manager, who in reality governed the bank; but, after all, the Leipziger Bank was one of the few provincial institutions left which was not, in one way or another, controlled by the big Berlin institutions. The conditions there were exceptional, and since then the checking system in all the banks has been very considerably improved. Even in the case of the Leipziger Bank depositors did not suffer any loss. The example of this bank, therefore, cannot be considered a proof against my contention, much less the Niederdeutsche Bank and other smaller institutions that failed recently—you might just as well use the failure of the Charing Cross Bank and some smaller concerns as an argument against the English banking system.

Let me give you some figures of the position of 46 German banks

(institutions with a capital below £500,000 are left out of consideration) at the end of 1910. The paid-up share capital amounted to £119,000,000, the reserves to £31,000,000; that is to say, about 25 per cent. The deposits amounted to £127,000,000, the credit balances to £240,000,000; together, £367,000,000; proportion of own capital to deposits about 40 per cent.

The assets were:

Cash and balances at the Reichsbank, &c. ...	£48,000,000
Bills receivable...	128,000,000
Advances on Stock Exchange securities ...	111,000,000
Investments	29,000,000
Syndicate and other participations	19,000,000
Debtors	261,000,000
and liabilities:	
Deposits and credit balances	367,000,000
Acceptances	97,000,000
Guarantees	33,000,000

The quickly realisable assets, leaving out syndicates and other participations, and naturally debtors, amounted to £316,000,000, against liabilities of £495,000,000, the proportion being roughly 65 per cent. Considering that amongst the debtors owing £261,000,000, partly covered, there are assuredly a great many who, if called upon, could make good their obligations almost instantly; and further taking into consideration that the heavy requirements towards the end of the year naturally influenced the status unfavourably, trade and industry being very active in Germany in 1910, there seems certainly no cause for concern. The process of concentration that has been going on for years in Germany, and is still going on, and the growing responsibilities of the enlarged boards of directors make, no doubt, for still greater circumspection and care in the future without necessarily affecting the policy of encouraging industrial development. The stronger the banking institutions become from year to year by building up reserves and increasing their capital, the more they raise the public confidence in their power and foresight, so much better will they promote the interests of industries.

You have seen that the industrial activity which set in after 1871 was overdone. Industrial development, however, received an intense and lasting stimulus by the nationalisation of the railways, which, until then, were privately owned, directly because extensions and improvements were taken in hand on a large scale, indirectly because very considerable amounts of capital became dislocated, seeking employment in other directions.

The leading financial circles, conscious of the importance of this economic change, commenced immediately to direct the flow of capital towards industrial enterprises of all descriptions, especially ironworks, collieries, machinery, manufactures, engineering and electrical establishments, &c., by way of promoting and floating companies, &c. Meanwhile, the company law has been greatly reformed and improved, protecting the public in every possible way from being deceived or misled by misstatements in the prospectus in respect of goodwill or otherwise. Under all circumstances two annual balance-sheets of the company after its registration have to be submitted before the securities can be introduced in the market. Most stringent regulations as to the responsibility of directors have been formulated. The prospectuses have to be signed by the issuing firms, who thereby make themselves responsible for the correctness of statements, and at the same time place their prestige and credit as issuing houses at stake. A committee of able bankers and merchants appointed by the Government, after most careful and searching investigation into the facts and figures in the prospectus, being authorised to demand any necessary explanations, has to express its opinion as to the desirability of allowing the security in question to be introduced and quoted on the Stock Exchange. All these precautions are most beneficial in creating an atmosphere of confidence and trust for industrial stocks, the more so as the banks themselves are invariably represented on the board of directors, exercising considerable influence in the management of affairs, not only in its financial but also in its general aspects. The experience of bankers being connected with a vast number of different concerns, and gaining inside knowledge of different industries, is often very valuable even in technical matters, in questions of amalgamations, combinations, cartels, &c. They are enabled to look at problems and situations not only as to how they will affect that particular company or industry, but from the point of view of the whole economic fabric in which they are greatly interested. Two examples will give you an illustration. The Government some years ago was at work to secretly acquire by purchases in the market the control of an important coal mine in order to become less dependent on the coal syndicate for the supply of its railways. The chief of a large Berlin institution intimately connected with that coal company devised some means by way of instantly increasing the share capital of the company in order to prevent the Government from exercising a controlling influence. Action was taken by the Government with a view to obtain a cancellation of the issue, holding that it was illegitimate, but the case was decided against the Government. True, the banking institution defended its own interests in the first place, but surely that of the whole industry also. In another case the manager of a very large iron works objected to the company joining the Steel Union. Admittedly it would have been to the advantage of that particular company to abstain, but the banking interests, considering it necessary for the sake of the industry as a whole, insisted upon it and succeeded in bringing these works into line, the manager resigning his position in consequence. In this way the individual interests are being subordinated to the interests of a larger community.

It is, I believe, safe to contend that the constant shifting and changing, adding and adapting in the industrial development is due as much to the banking influence as to the leaders of industry themselves. The formation of the cartels, syndicates, the combination of ironworks and collieries, the former acquiring the latter, and *vice versa*, are as much the doings of the financiers as of the captains of industry. Being so conversant with all the affairs of industries, and keeping in constant intimate touch, it is quite logical that the banks are ever ready to assist industries, even in times of stress. They make advances to them for extensions, for new equipment, for acquiring discreetly, if necessary, competing works, &c. These transactions, which naturally in themselves are profitable to them, will finally result in further issues of capital and placing and marketing of shares, &c., by which they again secure fresh revenues. They do not, and cannot, consider their function at an end with the issue of the capital; they recommend the security to their own *clientèle*, and they regulate the market if there is need. Important transactions in industrial securities take place on the Berlin and other German bourses daily. The public knows that not only are these investments of intrinsic merit, but also that they can easily dispose of them, even in times of great reaction.

Under the banking influence it has become more and more the policy of industrial companies to build up such reserves as to be able to avoid too sharp fluctuations in the dividend distributions. The balance-sheets of some companies give unmistakable evidence. I have got here the figures of Siemens & Halske, showing that since 1901 the capital has been increased from £2,700,000 to £3,150,000; the open reserve from £460,000 to £740,000; permanent investments, £560,000 to £3,200,000; buildings are unchanged at £500,000; tools, machinery, lighting plant, &c., are written down from £480,000 to 1s.; raw material is reduced from £300,000 to £100,000; manufactured and half-manufactured goods from £1,200,000 to £450,000; power station from £160,000 to £40,000; interests in other enterprises from £250,000 to £35,000. These figures tell a great tale. The permanent investments alone, as a result of the arrangement with Schuckert & Co., exceed the whole share capital. On the other hand, buildings stand at the same amount, regardless of the enormous extension of the works; tools, machinery, lighting plant, &c., have been written down to the extent of £480,000; stocks of raw material are valued at one-third of their book price of nine years ago; manufactured and half-manufactured goods are £700,000 less, in spite of the great increase in the business. Anybody who can read a balance-sheet will recognise the enormous reserves which are hidden in these figures. The dividends since 1901 have been as follows:—8 per cent., 4 per cent., 5 per cent., 7 per cent., 9 per cent., 10 per cent., twice 11 per cent., twice 12 per cent. The policy of stabilising, or rather to establish a minimum basis from which to advance but not to retreat, seems hardly disguised.

Much more imposing still are the figures of the General Electricity Co., that remarkable institution founded in 1883, as an off-shoot of Siemens & Halske, with a capital of £250,000, which has since gradually risen to £6,500,000, with probably not much less reserves. Machinery, tools, models and patents of each single factory controlled by the company have been written down to 1s. This will give you an idea to what extent the company has built up secret reserves in other ways. The last balance-sheet, when the capital was still £5,000,000, shows credit balances at banks amounting to £2,200,000. Needless to say that this institution is not any more dependent on banking credit, nor would it find great difficulties in placing its securities without the assistance of bankers. Still, the intimate relations between the banks and the A.E.G. still exist; representatives of all the leading banks are on its board, evidently because their co-operation is of direct and indirect benefit, and not because they are representing large shareholders. I do not wish to make out that these companies are typical examples; not every concern practises such extraordinarily conservative principles. Few can afford to divert such sums from their profits to reserves, but there is no question that, upon the whole, the industrial companies are well advised in their financial policy, which will aid in still more popularising their securities.

We find also amongst English companies such examples as J. & P. Coats, which company has since 1901 increased its capital from £9,000,000 to £10,500,000, at the same time reducing outstanding debentures from £2,000,000 to £500,000. The open reserve fund is now £6,578,000, which is £5,604,000 higher than in 1901. However, such cases are exceptions, but they are well appreciated by the public. The shares of J. & P. Coats stand at a price which, on the last dividend basis, return less than 3 per cent.

It is generally acknowledged that the progress made in the electrical industries in Germany has been most striking. Without disregarding any other factors conducive to this remarkable development, it seems to me that it was in large measure due to the intelligent and most liberal assistance by the financial circles that have quickly grasped the importance of this new industry. They have enabled the electrical undertakings to secure work in both hemispheres by financing them through all the different stages; they were instrumental in affiliating to the electric companies their own financial trusts and holding companies, and they have distributed the securities of all their enterprises, debentures and shares, into the investing channels. Without such faithful and powerful support, the electrical industries would never have forged ahead with such speed and acquired the commanding position which they hold.

In submitting to you a rough sketch of the financial construction and organisation of the industries in different countries, I believe I have shown that industrial credit does not necessarily involve banks in undue risks; that the organisation of the Continental banks, which are essentially credit

institutions, are efficiently equipped, both financially and intellectually, to cope with the industrial requirements; that the co-operation between banks and financial institutions and industries has proved upon the whole salutary to both; that the assistance of well-organised stock markets is needed for placing and popularising industrial stocks as investments. It seems to me that for practical purposes it is more essential to give attention to these points than to fiscal problems which have been under discussion for a considerable time. I will not tax your patience any longer in touching upon that subject, but conclude by thanking you very much for your kind attention.

The Chairman (Mr. H. W. Butler) said he was sure it would be the pleasure of the meeting that he should tender to Mr. Joseph a hearty vote of thanks for the very able manner in which he had brought the subject before them. The paper certainly bristled with many important points, and they were very fortunate in having had the question laid before them by an expert who had had opportunities of studying the various developments that had taken place in regard to banks and industrial finance in many countries. Before calling upon gentlemen to open the discussion, he wished to say that telegrams of regret at their inability to be present had been received from Mr. Bruce Anderson and Mr. E. Garcke.

Mr. Theodore Rich said that not merely the electrical industry, but other industries in this country, were deeply indebted to Mr. Joseph for his paper. We lived on an island, and as an "island" people we were apt to be insular and to think that institutions and arrangements of our own must be better than anyone else's. Therefore, a paper such as they had just listened to, whatever their opinions on business matters, was one that all classes of industry should be most thankful. The electrical industry, and many other industries, were frequently told in certain sections of the Press that they had lost business through lack of genius, or lack of "go" or enterprise. The paper made one ask the question—was it due to lack of genius, or enterprise, or was it due to the lack of facilities to use that "go" and enterprise which we possessed, to the best advantage. He thought many of them would agree that it was to lack of adequate financial facilities to utilise the great talents that we had got in this country, that we owed a great deal of our troubles to-day. Our position in this country was more allied to that of Germany than that of America. In America there was an enormous field for the use of industrial capital, so that very little had to go out of the country; but it would seem that even the American nation were beginning to understand that if they sent money out of the country in the right way, they could get a very great deal of it back, and a great deal more than they sent away. In Germany things were very much the same as here—that country was not able to utilise all the capital which it had got. The question which naturally arose was whether the existing banking institutions could take on industrial business, and that, he thought, was one of the most difficult problems before financiers in this country. We could not blame the bankers, as they had grown up under the present system. The banker in this country was a bill broker, pure and simple. He said, "we have got in London the money market of the world; and as long as we have got the money market of the world there cannot be anything very wrong," and his business was so organised that it was absolutely impossible for him to touch anything in the nature of locked-up capital. He thought he could see the reason why the bankers took up that position. Our banking system was carried on to-day on a small pile of sovereigns with an enormous pyramid of business on the top, and the bankers had got to be very careful that none of those props were taken away so as to endanger the pyramid. The large banks in Germany had a paid-up capital of 119 millions, while our banks had a capital of only 34 millions. The German banker traded very largely on his own capital; the English banker traded very largely on the capital of his depositors. The result was that the English banker dare not do anything which tended to lock up his capital. The banker in England did not care two-pence what was done with his money, so long as he was paid his interest. In Germany it was very different—the banks there would lend money on many things that one could not borrow upon here. The whole German system permeated their banking system, as was the case at home, and we could not change our system until the whole system on which the country had been run for 30 years was changed. Directly one came down to hard facts, people said they did not wish to discuss the matter any more. The bankers in England say—look at the record of the past 30 years—millions of pounds have been utterly wasted in industrial promotion, because there are no responsible parties to look after that industrial promotion. It was no use blaming the banks for the appalling waste in industrial capital, which had gone on for so many years. One result of the German system was that the man in the street, and the financier in his office, took an interest in the industries and in the industrial progress of his country, and everyone liked to have a finger in the pie. Here, however, the leading financiers of London had practically no interest in our industries at all—many, indeed, had negative interest in so far as they helped to push the interests of other countries. The industrial capital here was very largely in the hands of large capitalists, and was not spread over the people as it was abroad. In Germany it was spread over the people, and, therefore, everybody took an interest in pushing it. If we could devise some system by which industrial capital was spread very much more than it was to-day amongst everybody, we should have everybody very anxious to spread our industries. At present one had got to be a company promoter in order to raise money for industrial enterprise, and such a man had no liabilities. As long as he could float the company and make a profit, he did not care two-pence what happened afterwards. The man who floated 25 companies and made a a fortune in the process, although the bulk of them were failures, would be honoured by the people and told that he was a smart man. That was because the big banking concerns took no interest in the matter, and it was nobody's business to see that things went right. It was said by some people that these big financial concerns in Germany tended to deaden individual enterprise. That might be true to a certain extent, but they kept the money in the country on the right lines in such a way that it was for the benefit of the country, and that was what was wanted. When Germany started to build up an industrial nation, she said, "We must see that what little capital we have got circulates in such a way as to do us the maximum amount of good," and that was the lines on which Germany had been run for the last 30 years. We could not shut our eyes to the fact that this question was one of national economics. He was inclined to think that in this country we were too fond of talking about liberty, and we thought too little of duty. If we had our industrial interests more bound up with the people, as was the case in Germany, he was convinced we should get on much better than we did.

Mr. Myers said his experience of the English banker was that, so long as he had a realisable asset, he seemed to be quite satisfied. He was in agreement with all that the previous speaker had said. The English banker did not look at the nature of the security so much as its realisability, and that of course was wholly due to the nature of the business in which he was employed. With regard to the difference of finance as applied to industry, between the English and the German nation—because he was afraid they would have to keep to the comparison with their competitor who was close at their doors—he quite agreed with Mr. Joseph and the last speaker, that some sort of organised authority was almost a necessity for us under present circumstances. Germany, and the large German institutions in the electrical industry particularly, had the advantage not only of organised capital in a superlative degree, but of organised experts, and the combination of the expert with the financial genius was almost irresistible, and when they got it combined in a single individual it meant success. Their long training in Germany had brought this about in many individuals, and to a very large extent they had supplied the capital for work abroad. Germany was the largest competitor of England not only in South America where the field for electrical energy was being rapidly filled up, but in our own Colonies. There was one large company, the Victoria Falls Power Co., which ought to have been wholly financed by English capital. That was an undertaking, the merits of which were wholly known to a large number of people in England. When the time came for the capital to be raised here it was found to be difficult to get it—people did not quite believe the English experts; they did not think the contracts could be obtained for a sufficiently long period, and there were doubts as to the ability to raise the large amount of capital that was necessary. The result was that while the large English financial houses were considering the matter and thinking of sending out experts, the Germans had been approached and had made a proposition that if they could have the orders for the machinery, and could also see their way to install the by-products of the machinery which the mines would require, they would be prepared to pay £100 debenture money for every £100 of preference money which was put up behind those debentures. The result to-day was that the Germans would have three millions sterling in debentures, and England would have found three millions sterling in preference shares behind those debentures; and the Germans to-day had received orders for six millions sterling of work, and would receive orders for another two or three millions before long. He believed that if we had some organised industrial bank which could examine things, and which would give to the capitalist leaders in London that assurance which the A.E.G. gave, none of those contracts would have gone out of this country. Immediately the large German financial institutions and the German experts had set their hall mark upon this enterprise, the English capitalists came forward, and said it was a good thing for them, but not for one moment did they investigate it for themselves. He could give similar instances in South America, where business went past this country for the same reason—lack of investigation. That such a large institution would drown the smaller individual, was, he thought, certain, and also it would not be good for the smaller individual, but it might be for the good of the country as a whole.

Mr. Hooghwinkel remarked that he had listened with interest to the paper, and to the remarks of the last two speakers, with whom he found himself in complete agreement. The example that Mr. Myers had given them was not even a general one, because in the South African scheme to which he had referred, we had certain advantages. The country was English, and English experts had been on the spot. There were many other examples, both in South and Central America, and in the Far East where the difficulties were the same. There were cases he had in his mind where the English experts had been on the spot, but owing to our slow methods, and while we were negotiating for 10 years' options and things like that, the German came along with power of attorney to clinch the matter, and, as a rule, he did it at lower prices than we could. He (the speaker) considered this a most vital matter for the electrical industry, and he had been thinking whether it would not be possible in some way to come to some definite agreement as to how they could bring about an alteration in the present condition of things. The idea, which, of course, had doubtless occurred to almost everybody present, would be the establishment of an industrial bank for the electrical industry. Three or four such banks existed in Germany at the present moment. There had been a lot of talk about that question for the last three or four years, but they had not got very much further. He would like to suggest

that the Association should take up the question officially, and should call a meeting to discuss it. His idea was that a committee should be formed from the Manufacturers' Association to consult with some of the bankers—he did not say the Bankers' Institution, but some selected bankers. If that were done, they might possibly come to some definite conclusion on the matter.

Mr. Hugo Hirst said it was very difficult on the spur of the moment to single out a point of particular interest in a paper which had lasted nearly an hour; as far as he was concerned, he felt inclined to emphasise almost every point that had been mentioned. In his introduction, Mr. Joseph had said that the reason why companies were formed was because it was desired to introduce wealthy people to the assistance of the industrial concerns. He (Mr. Hirst) would just like to dwell upon that point, and to inquire whether it was possible under our present system to introduce influential people to the help of the industrial concerns, or was it more possible under the German system. Under our system it was perfectly true that they could get money, but they had to get it by means of a prospectus, which was often coloured to such an extent that it was often difficult to get near it, even if they were successful. But, as a rule, the shareholders who came in had no interest in the business—their only desire was for dividends. The great difficulty was that often the industrial knew nothing of finance; and once he got more money than he required, then his trouble commenced. He often got careless in the management of his business because he had more money than he needed, and he schemed as to how best he could invest the surplus money at his disposal, and for that he had no experience. He just needed that advice which the German banks or the German financiers gave, and which in the old days was given by the private banks here, but which, under our present system, it was impossible to obtain. He knew many cases where the influx of capital to industrial enterprises had not been the means of helping those industries. According to the German system, money could be obtained after due investigation; money could be obtained quickly when it was wanted. The banker took a certain responsibility, and if the manufacturer did his duty he could always get a bit more in case it was wanted, and a dangerous position was thereby frequently turned to success. Another observation he would like to make was that it occurred to him how beautifully organised by means of industrial banks was the industry of the whole country in Germany as compared with ours. He read a startling headline the other day in one of the daily papers, that Germany had suddenly decided to send technical men as attachés to embassies abroad. Some of them were inclined to ask why England did not do the same. According to the present system in Germany, where the banks were not only interested in the electrical industry but in every industry, and where in consequence they knew the feeling and the possibilities of the country, they had power to speak to the Government as experts as well as representing the business interests, and in that case he could well imagine that the technical experts would be of great benefit to the German nation. What could technical experts in our English embassies do for their industries? They might report to the Board of Trade, but what did that Department do with such reports? All these big schemes that were looming in foreign countries could be dealt with by the organisation that they had abroad, but they could not possibly be dealt with by individual firms backed up by money, if they were not backed up by the technical experience which was at the disposal of our foreign competitors.

Mr. Oppenheimer said it was rather difficult to take part in the discussion of a paper which was so full of information, much of which was of a special character that could only properly be dealt with by experts. He saw a number of gentlemen connected with the Stock Exchange present, and it was a little surprising that those gentlemen should not give the meeting the benefit of their experience. One very able representative of the Stock Exchange who had spoken had hit out in the right direction when he explained how totally different our methods were as compared with those prevailing on the Continent, and how successful those who were working in the interests of German banks had been in securing a contract for six millions sterling, and getting a mortgage for that sum, whereas we had been waiting, thinking and contemplating, with the result that we had got only a deferred financial position, and no contract. That was the general outcome of the national disposition that prevailed in this country—slow and sure. Of course the absolute surety which we had in England, as far as banking business was concerned, had its advantages. A financial crisis occurring at any moment would certainly not affect the English banks—whether that was so sure to be the case on the Continent was not a matter for him to discuss or even question. What he wanted to point out, and what was particularly interesting in the paper, was that Mr. Joseph in his highly interesting review of the position of the various countries which were at the present moment marching at the head of industrial progress, employed totally different methods to obtain the result. It had been said by every speaker that the lack of mobility, the lack of financial assistance and the lack of machinery were responsible for our ill-success from an industrial point of view generally. When they looked at the Lancashire cotton industry cited by Mr. Joseph, it was useful to inquire how that great industry was created. It was not created by the large joint-stock banks—it was created by the support of the private banks; and exactly the same thing had happened in Germany. He differed from Mr. Joseph when he said that the industrial progress in Germany took its rise from the large banking businesses. He differed entirely from that statement, because it would be found that the German banks took a leaf out of the books of the Lancashire private banks, and where there was a local industry they nursed it. He saw present that evening one gentleman from a country where there was certainly a large amount of industry in existence, which, to his (the speaker's) mind, was fostered and nursed exclusively by the support of private banking capital. After the general rise and progress financially of Germany, it was an easy matter for those gentlemen who were at the head of the banking business to pick out those crops which had been nursed and matured and afterwards come and support them with unlimited capital. It was, however, the private bank which was the very first to start the local industry, and which had been responsible for its development. Exactly the same would be the case to-day if our large banking institutions were not exclusively controlled by the large trusts as represented by joint-stock banks. The first speaker hit the nail on the head when he described the banking institutions of this country as authorised bill brokers. That, however, was not the whole case. An ordinary industrial going to his banker and desirous of discounting a bill would be told by the manager that he would like to see what was standing to his credit, and the consequence was that unless one's balance was sufficiently large, the bank would not discount the bill. He did not consider that modern or up-to-date banking methods. They could not, however, expect anything different, because those gentlemen who controlled our financial interests were very ready to advance unlimited sums to those connected with the Stock Exchange, who simply required daily accommodation; but when the industrial concern went, be it ever so sound and ever so splendidly organised and managed, they found the coffers of the bank locked. That, unfortunately, was the position of affairs in this country.

Mr. Donovan remarked that he thought Mr. Joseph had started off on a false assumption. He had said that the financial change in this country came about with the introduction of machinery. That, however, was not so, in his (the speaker's) opinion—it commenced with the Bank Charter Act of 1844, when gold was made the legal standard for the payment of debts. That was the cause of the present banking system, as it gradually shut up the private banks and prevented them from issuing paper money, which had, up to that time, been of great service in all country districts. If they traced the extinction of the private banks, it would be found that the agricultural industry in this country had steadily declined from the time of the passing of the Bank Charter Act. There was no definite date at which it could be said that machinery was introduced into this country; that had been a gradual process.

Mr. Madgen said he came from Northumberland, the premier county in England. The climate of England was very variable and very uncertain, and yet, notwithstanding its many disadvantages, this country had been subject to invasion from time immemorial. People from other countries came in their thousands to try and conquer us, and they still came. Were it not so, they would not be welcoming many of their best friends, some of whom had spoken that evening. He could not help thinking that there was something in our institutions; there was still something in our methods. One of our curious characteristics was that we listened with patience to the lectures which were frequently addressed to us by gentlemen, of whom he wished to speak with the greatest affection and goodwill, on our shortcomings. As to Mr. Joseph, he had made some comparisons between the business methods of this country and other countries, but he had done it in a very nice way. He had given them a statement of fact, and left them to draw their own conclusions. The only statement of fact with which he was inclined to differ was Mr. Joseph's description of what he appeared to regard as the formation of a typical industrial company in this country. He described a firm, the members of which were growing old and seeking to retire from business, and they called in the aid of the wicked company promoter. According to the lecturer, the capital was inflated, and the company came to an untimely and discreditable end. He did not think that was quite a fair description of the average methods of this country. There were other companies, and a large number of them were honestly formed, honestly managed, and very successful. The form of company described by Mr. Joseph was, he should say, the exception, and not the rule. There was another point which he thought Mr. Joseph had not laid sufficient emphasis upon—he had not referred to the very large number of financial houses and trust companies which devoted themselves in an expert and efficient manner to study, support, and control the different classes of business. There were houses of that description in the City, in Manchester, Glasgow, and all the large centres—wealthy, respectable firms, sometimes private firms, sometimes trust companies, which made a speciality of cotton investments, mining investments, &c., and which fulfilled all the functions that the German banks did, and in a more efficient manner. He could not resist getting the impression from the paper, and from similar lectures that he had heard before, that in Germany and America the banks did not exist so much for the industries, as the industries appeared to exist for the banks.

The Chairman said it seemed very evident from what they had heard, that the English banks were not so much to blame. While they could find sufficient employment for their funds to return their shareholders 20 per cent. dividend, they could well be content, and consider that they were doing good business. That being so, it was very evident that it was no good trying to reform those banks, and the speaker who suggested that industrial banks should be formed for the special purpose of industrial enterprise appeared to him (the chairman) to have hit the nail on the head. It was like throwing eggs against a brick wall to endeavour to convert the banking interests of this country to their way of thinking. What they had to do was to organise, or to assist in organising, a banking institute which would give them the facilities which the German banks gave to the industrial enterprises in that country. The industrial enterprise of the German banks was, he took it,

chiefly because they had not got the ready means of turning over their capital sufficiently often to produce the necessary dividends for their shareholders. The English banks, on the other hand, owing, he supposed, to the fact that the Stock Exchange required so much money which they only wanted from day to day, and to the fact that the banks lent so many short loans—did not need to trouble to consider the question of industrial finance. It did not seem to be possible to do anything until some fresh banking industry arose in this country which would look at matters from their point of view.

MR. JOSEPH, in replying on the discussion, said that with regard to the suggestion that some steps should be taken to provide industrial banks for England, he would point out that it was no use to embark on any such project before they were able to create an atmosphere of confidence in their industrial enterprises. That confidence could only be created by sufficiently safeguarding the promotions and the management of the company's affairs. As he had shown them, in spite of the modifications which had been made in company law, there were still a great many methods of getting round the law. In Germany the Government took care of the capital of the public, and he thought that the first alteration needed in this country was along those lines. Mr. Donovan was incorrect in assuming that he (the speaker) had stated that the financial changes which had taken place in England were due to the introduction of machinery. What he said was that the whole economic structure was changed at the time of the introduction of machinery, which, along with improvements in equipment, necessarily required the use of much larger capital than before. It was that state of affairs which brought about the formation of companies, and since that time industries had generally organised themselves into public companies or corporations. Mr. Madgen was not satisfied with many of the things he had said in his paper. He had no wish whatever to produce a picture of prosperity in Germany—he had simply laid the case before them as it existed. He told them that in Germany such and such conditions prevailed, and that in England and America such and such conditions prevailed. He did not think he had in any way misrepresented the facts. Everybody must be left to draw their own conclusions, but he hardly thought Mr. Madgen was right in saying that he doubted very much whether the banks in Germany existed for the industries, or whether the industries did not exist for the banks. After all, the proof of the pudding was in the eating. If they could show him that the industrial system in Germany had fared badly by being so intimately connected with the banks they would be perfectly right, but if he could show them that the German industrial undertakings had from year to year solidified their foundations and increased their intrinsic reserve and their dividends, then he thought they would agree that he was right in saying that the industries profited from the banks. The object of his paper was to try and find some method to enable the English industrial concerns to progress in the same way that German industries had done. He did not think there was any fault to find with the banks because they had made large profits out of the industries. They had given their work and their capital, and he did not see why they should not benefit.

MR. MADGEN: What about the small man?

MR. JOSEPH said he should say that the small man in Germany had fared in the same way as the small man in England; perhaps better. He did not think that the small man in Germany was wiped out—they found quite small men in trade in that country. The small industrial concerns in Germany were being gradually absorbed—they were gradually becoming companies themselves. As regarded Mr. Oppenheimer's remarks in respect of private banks, what he (Mr. Joseph) had said was that the whole banking community in Germany had helped to foster industrial companies—not merely the joint stock banks.

The proceedings then termininated.

The Carnegie Non-Magnetic Yacht.—The non-magnetic yacht *Carnegie*, which recently reached Buenos Ayres, found two grave errors on the British Admiralty charts in her voyage to Great Britain, and returning *via* the Azores she found that a captain who ran a great steamer upon the rocks was not to blame. On the contrary, he was sailing on the right course according to his chart, but the yacht proved that the chart was from two to three degrees inaccurate.—*Metal Industry.*

A Paraguayan Electrical Concession.—It is announced from Ascencion that M. Carosio, who represents the A.E.G. in Buenos Ayres, has obtained a concession for the establishment of electric lighting and tramways in Ascencion and its suburbs, although the English contractors for the extension of the Central Railway at that place took every possible step to secure the concession for themselves. The concession is for a period of 30 years, at the expiration of which, the tramway track down to 1920, and the cables and mains and the rolling stock will pass into the possession of the town, free of charge. All machinery, materials and fuel can be imported free of duty, and the undertaking will be exempt from State and municipal taxes in return for the payment to the town of 5 per cent. of the gross receipts from passenger fares and from freight charges. The power station is to be completed 18 months after the execution of the contract with the city authorities, and at least 7½ miles of line must also be opened for traffic by that time. On the lapse of a further period of two months the deposit of £6,000 made by the holder of the concession is to be returned. It is reported, although without any confirmation, that machinery and materials have already been shipped from Hamburg for the undertaking.

PROCEEDINGS OF INSTITUTIONS.

Imperial Telegraphs.

AT a meeting of the ROYAL COLONIAL INSTITUTE held at the Hotel Metropole on the 25th ult., with Sir Frederick Young, K.C.M.G., in the chair, MR. CHARLES BRIGHT, F.R.S.E., read a paper on the subject of "Imperial Telegraphs." The question was dealt with from the Imperial standpoint; the present position of existing routes was explained, and new cables were advocated as part of a general plan for securing, in time of war, communication between the different parts of our world-wide empire. The importance of the present cables was shown by the statement that they were 265,000 miles long, and have cost 5½ million pounds, or an average of £200 per mile. The average life of a cable is now placed at 30 to 40 years, the maximum speed of working at about 100 words per minute, and the percentage of coded to ordinary messages is given as 90 per cent. Practically 6 million messages are sent every year or an average of about 15 thousand per day.

The author pointed to the large proportion of deep-sea cables owned by private companies, and remarked upon the activity of foreign Governments in laying State-owned cables to their distant possessions. The lax attitude which had been adopted by our own Government when granting landing rights and arranging subsidies was criticised, and the question of tariffs carefully examined. Mr. Bright was in favour of a uniform cable tariff, and showed that the risks which were involved in adopting a comparatively low rate per word were not insuperable. Many cables were not worked at anything like their full capacity, and he advocated, in addition to the uniform rate for ordinary messages, the deferred-message low-rate system, by which in return for paying a lower rate, a message might be sent forward as best found convenient within a covering period of, say, 12 or 24 hours. By thus equalising the load, and at the same time utilising the cable relay by which the earning capacity of a cable could be increased, it would be possible to a large extent to neutralise the loss caused by the lower message rate. The advantage of cheap and rapid intercommunication between different parts of the empire was obvious. It was, however, essential that such communication should be free from interruption, when most wanted in time of war, and, to secure this end, new cables were in many cases essential.

The Pacific cable was instanced as a first instalment of the system of Imperial telegraphs, and the rest of the paper was mainly devoted to an examination of the telegraphic needs of the empire, and the best means of meeting them by laying new lines between British-owned landing places.

A short discussion followed the reading of the paper, when most of the speakers agreed as to the importance of the subject, and expressed the hope that it would be discussed at the coming Imperial Conference.

COLONEL RAWSON, R.E., thought that the case for greater stringency on the part of the Government when the question of granting landing concessions to privately-owned cables was under consideration, had been fully established.

MR. F. C. C. NEILSEN disagreed with many of Mr. Bright's conclusions, and argued that there was no reasonable ground for supposing that a uniform low tariff would mean financial success. Many cables were already fully loaded, and increased traffic would mean new cables, with consequently increased capital charges. He was of opinion that the Northern Atlantic route recommended by Mr. Bright would experience trouble from ice, and that several of the other proposals would be unremunerative.

MR. BRIGHT, in reply, repeated that he was discussing the question from an Imperial standpoint, and that the question of Imperial safety in time of war was the paramount consideration. The lines would, when constructed, do much to foster commercial and social relations between the various sections of the Empire, and would aid in welding together in a common interest the scattered Dominions of the Crown. The most pressing part of the problem is the State-owned Atlantic cable, this with the Canadian land-lines, and the existing Pacific cable, would connect up this country with both Canada and Australia and New Zealand, while a line between Gibraltar and Bathurst would in like manner complete the All-Red South African communication. Other lines could be laid as opportunity served.

Battery Economics and Battery Discharge Arrangements.

By A. M. TAYLOR, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, April 27th*, 1911.)

IT is now some 2½ years since the author read a paper before the Municipal Electrical Association at Nottingham, on the subject of accumulators for peak loads, and the correctness of the principles then enunciated has been in some measure verified. The author is now able to point with some satisfaction to the large battery installed by Mr. Pearce at Manchester, on which results of the most gratifying nature are being obtained, the coal bill being reduced by some 25 per cent., apart from large savings in the fixed charges.

The whole question of the utilisation of accumulators for rapid discharge rates is very intimately bound up with the final cell voltages on discharge, as well as with the number of ampere-hours that can be taken out of the battery.

In fig. 1 will be found a curve connecting ampere-hours with hours of discharge, the values of which between the 10-hour rate and the 1-hour rate are taken from English practice, and those

between the 1-hour rate and the 5-minute rate are estimated values which, however, are very closely confirmed by the values obtained with the Exide cells. In fig. 2 are given the initial and final discharge voltages for different periods of discharge. Here, again, the English figures below the 1-hour rate are merely estimated, but it will be seen that they follow the same tendency as the actual values

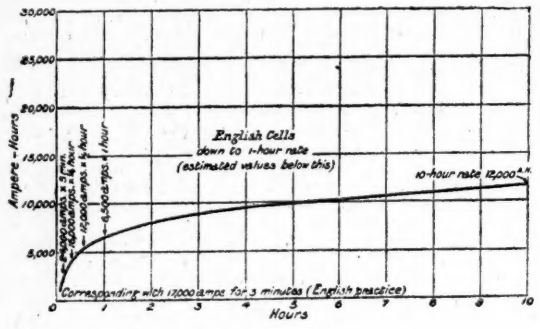


FIG. 1.

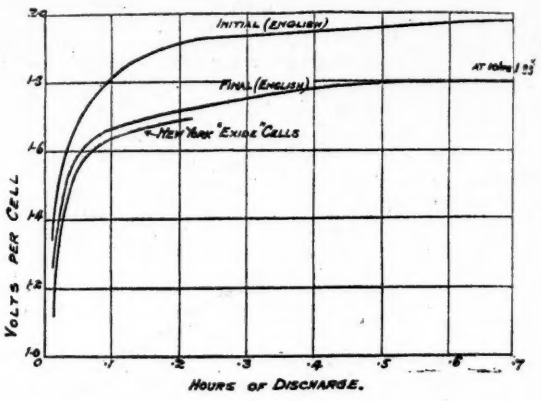


FIG. 2.

obtained on the Exide cells. In fig. 3 a series of curves is given, showing the result that might be obtained on a cell of a given type and size if charged and discharged at different rates. On the same sheet are shown the performances of the Tudor cells under similar conditions.

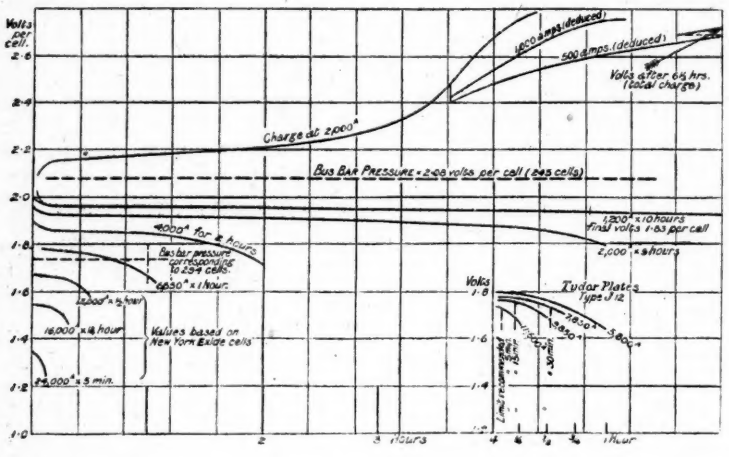

Charge at 2000 A
Bus Bar Pressure = 2·08 volts per cell (643 cells)
Tudor Plates Type J 12
Values based on New York Exide cells
Hours
1 Hour

FIG. 3.

The method of discharging large batteries by means of regulating cells has been employed on a considerable scale both in America and on the Continent, whereas in Great Britain, owing no doubt to J. S. Highfield's activities in 1901, the tendency has rather been to employ boosters for the discharge. Though the former method of

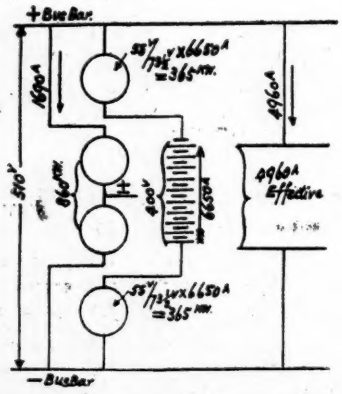


FIG. 4.—ORDINARY ARRANGEMENT. 1-HOUR DISCHARGE. 240 CELLS. Note.—The 73½ volts is for the charge.

working batteries is very simple and reliable, it has many disadvantages, especially where rapid rates of discharge are likely to be required.

Up to the present time it has been very costly to obtain from boosters the necessary boost to get the discharges which are indicated in fig. 1 out of the batteries. The voltage of the boosters has to be increased to such a degree that, combined with the high current rate, the resulting kilowatt capacity becomes very expensive to provide for. Virtually this has, in the author's opinion, resulted in an insufficient provision being made in boosters for discharging the battery at emergency rates, and it seems to be considered good enough either to throw the battery direct on to the bus-bars on emergency conditions or to draw upon reserves (as, for instance, at Manchester). This, of course, means either that the batteries will never give the discharge they are capable of giving, or that, in order to obtain this discharge the bus-bar pressure at the station must fall tremendously. This is, of course, a serious matter for a central station to face. The author hopes to show that it is practicable to put in boosters to deal with a ¼-hour discharge at a cost not exceeding what is at present spent in obtaining a 1-hour rate of discharge, and that the cost for boosters, in the case of the 1-hour rate, may be reduced to less than one-half of what is now spent upon them, with an all-round gain in efficiency.

The author has made an investigation into a particular case in which it is desired to deliver an effective discharge on to the bus-bars of 2,530 KW. (510 volts) for one hour, or 5,140 KW. for ¼ hour, or 6,370 KW. for 5 minutes. The two battery charge and discharge curves, given in figs. 6 and 7, respectively indicate the outputs required from the boosters in the case of the arrangements shown in figs. 4 and 5, the 1-hour rate of discharge being taken for comparison in each case. In will be noted, on referring to fig. 4, that the battery current has to be 1,690 amperes greater than necessary to reproduce the effective line current of 4,960 amperes. Referring now to fig. 5, it will be seen that the battery has in this case to supply only 5,500 amperes, as against 6,650 amperes in fig. 4, for the same effective line current, the 1,150 amperes thus saved permitting a smaller size of cell to be used. This does not, however, appreciably reduce the cost of the battery itself, as a rather larger number of cells is required than in fig. 6. It will be noted, however, that whereas the output of the booster in fig. 4 is 365 × 2 = 730 KW., it

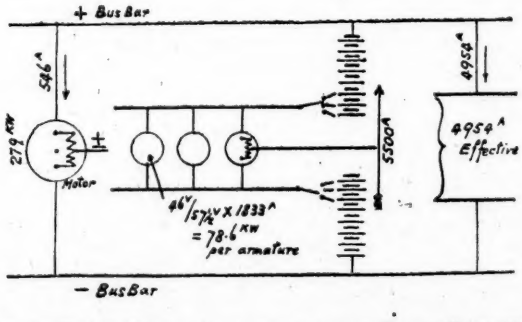


FIG. 5.—TRIPLE-SERIES ARRANGEMENT WITH STATIC BALANCERS. 1-HOUR DISCHARGE. 280 CELLS. Note.—The 57½ volts is for the charge.

is in fig. 5 reduced to 78·6 × 3 = 236 KW., a saving of nearly 500 KW. (1-hour rating). This means that, whenever the boosters in fig. 4 are running, an unnecessary amount of machinery, to the extent of some 500 KW., is being continually turned round, repre-

senting a perpetual waste of energy which is of the order of 116,000 units per annum. The two sets of curves in figs. 6 and 7 show very clearly, by the relative areas of the booster curves on discharge, the above saving.*

A summary of the conditions obtaining in the three different methods above alluded to—viz., regulating cells, ordinary boosters, and "triple series" boosters—will be found in Table A, which also gives an approximate estimate of the cost of the batteries and of the boosters.

In another scheme the number of cells is so chosen that the maximum, or peak, output occurs at such a period of the discharge of the battery that practically no boost is at that time required for the latter. For, say, one-quarter of an hour on either side of this point the boosters are worked with their armatures in parallel and are thus able to deal easily with the 6,650 amperes. During the earlier and later portion of the peak, however, the current being then much less, the booster armatures are put in series with each other. A few regulating cells may be employed if desired, and these could be cut out should the discharge rate require to be reduced in the early part of the discharge beyond that shown by the curve.

If traction bus-bars were available, or a rotary converter could be modified to give sufficient voltage range for the charging of the cells (assisted by the battery boosters) the output of the battery boosters could, in the latter case, be reduced to as small a value as 66½ KW. (10 volts × 6,650 amperes). If, however, neither a suitable rotary converter nor traction bus-bars were available, it would be necessary to put in boosters, if with the triple-series method, for at least 30 volts apiece, making a total booster-rating capacity on a 1-hour discharge equal to 198 KW. (30 volts × 6,650 amperes). Even this would be a distinct saving over the arrangement shown in fig. 5; where the aggregate capacity is 236 KW. (exclusive of spares), and a still greater gain over the arrangement shown in fig. 4 where the capacity is 730 KW.

TABLE A.

Description.	Period of discharge.	(Gross) kilowatts of discharge to B/B (at 510 volts).	Effective kilowatts of discharge to B/B.	Battery amperes of discharge.	Number of cells.	Number of regulating cells.	Booster discharge in kilowatts (at machine).	Motor current (at 510 volts).	Effective line current.	Final discharge E.M.F. per cell.	Output of auxiliary booster (kilowatts).	Total cost per effective kilowatt on B/B.
	Hour.											£
Entirely with regulating cells	1	2,530	2,530	4,960	303	113	—	—	4,960	1·67	—	6·86
	¼	5,140	5,140	10,070	332	144	—	—	10,070	1·46	—	4·18
	1/12	6,370	6,370	12,500	365	176	—	—	12,500	1·26	—	3·04
Ordinary booster with motor balancer	1	3,390	2,530	6,650	240	Nil.	730	1,690	4,960	1·67	—	7·14
	¼	8,150	5,140	16,000	240	Nil.	2,560	5,930	10,070	1·46	—	4·88
	1/12	12,200	6,370	24,000	240	Nil.	4,980	11,500	12,500	1·26	—	4·71
						For balancing						
Triple series parallel booster with static balancer	1	2,810	2,530	5,500	280	10	236	546	4,954	1·67	58½	6·11
	¼	6,700	5,140	13,110	280	10	1,314	3,040	10,070	1·46	58½	3·84
	1/12	9,970	6,370	19,550	280	10	3,039	7,050	12,500	1·26	58½	3·74

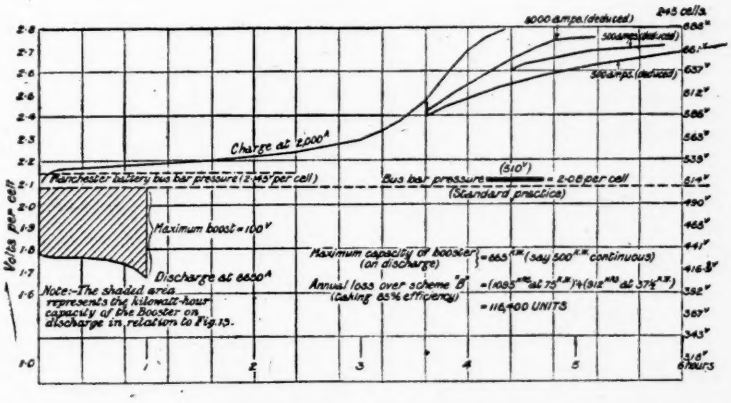

6000 amps (reduced)
245 cells
Charge at 2000A
Manchester battery bus bar pressure (2·45 per cell)
Bus bar pressure (510V) = 2·08 per cell
(Standard practice)
Maximum boost = 100V
Discharge at 6650A
Maximum capacity of booster (on discharge) = 665 KW (say 500 KW continuous)
Annual loss over scheme "B" (using 85% efficiency) = 116,400 UNITS
Note:-The shaded area represents the kilowatt-hour capacity of the Booster on discharge in relation to Fig. 13.
Volts per cell
6 hours

FIG. 6 (SCHEME A).—ORDINARY BOOST ARRANGEMENT. Standard arrangement of booster and battery (245 cells).

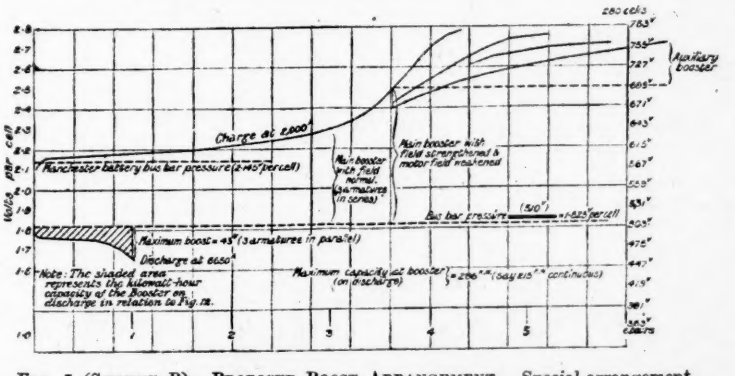

280 cells
Charge at 2000A
Manchester battery bus bar pressure (2·40 per cell)
Main booster with field normal (3 armatures in series)
Main booster with Field shunt & motor field weakened
Auxiliary booster
Bus bar pressure (510V) = 1·825 per cell
Maximum boost = 45V (3 armatures in parallel)
Discharge at 6650A
Maximum capacity of booster (on discharge) = 266 KW (say 215 KW continuous)
Note: The shaded area represents the kilowatt-hour capacity of the Booster on discharge in relation to Fig. 12.
Volts per cell
6 hours

FIG. 7 (SCHEME B).—PROPOSED BOOST ARRANGEMENT. Special arrangement of booster and battery (280 cells).

The following particulars relate to the installation of 150 cells at the Sixteenth Street sub-station of the New York Edison Co. These cells are capable of giving 10,790 amperes for 1 hour, 21,580 amperes for 21 minutes, 32,370 amperes for 10 minutes, or 43,160 amperes for 6 minutes. The 6-minute rate is four times the 1-hour rate. The battery is used as a pure standby, and simply floats on the bus-bars, and the regulating switches are automatically operated in such a manner that when a sudden discharge is required they will travel along rapidly to the contact required to give the prearranged bus-bar voltage at the prearranged discharge. Of the 150 cells, no fewer than 68 are regulating cells. The switches are designed to travel along from contact to contact under any current up to 40,000 amperes. The floor space required for a battery of 280 cells works out at about 0·3 sq. ft. per KW. for a bus-bar pressure of, say, 460 volts. Such an arrangement compares very favourably as regards floor space with boilers, engines and alternators; the cost of cells alone is probably not much over £3 per KW. for a 6-minute rate, and compares very favourably indeed with any form of steam plant. Moreover, every central station engineer knows the extreme value of having stand-by plant which is absolutely ready to give instantaneously any discharge required from it.

Between June, 1909, and June, 1910, batteries have been installed in New York, Chicago, Brooklyn, Boston and Washington, aggregating some 49,000 KW. at the 6-minute rate. The author, however, thinks that, valuable as this special class of battery may be as a stand-by, the savings to be introduced by working the battery in a regular way as a substitute for the use of steam plant, where the load is of a peaky nature, are so great that it will not be found advisable to put in batteries exclusively for the one class of work.

A statement of the probable saving by the introduction of accumulators, in place of additional steam or gas generating plant,

* The curves in fig. 6 have by mistake been got out for 245 cells instead of 240, and the figures on this curve therefore do not quite agree with those in Table A, but the difference is unimportant.

may not be without interest. The case chosen is one involving the delivery of an additional peak load of 1,450 KW. on the direct-current bus-bars in a sub-station at a distance of 1 mile from the main generating station, representing a load at the generating station of, say, 1,540 KW., the transmission being by high-tension alternating current and rotary converters.

TABLE B.—ANNUAL CHARGES FOR 1,450 KW. (ADDITIONAL) MAXIMUM DEMAND ON SUB-STATION BUS-BARS.

(Remainder of Day Supplied from Rotaries.)

Peak hours per day.	Equivalent load factor (approximate).	Fixed charges per kilowatt.	Running charges per unit.	Total annual sum.	Fixed charges per kilowatt.	Running charges per unit.	Total annual sum.
		Steam plant (coal at 12s.).			Battery (coal at 12s.).		
	Per cent.	£	d.	£	£	d.	£
1	4	3·89	0·221	6,141	1·54	0·330	2,976
2	8	3·89	0·221	6,638	2·21	0·330	4,691
5	20	3·89	0·221	8,129	3·89	0·330	9,360
		Gas plant (coal at 12s.).			Battery (coal at 12s.).		
1	4	3·82	0·082	5,717	1·54	0·120	2,507
2	8	3·82	0·082	5,902	2·21	0·120	3,753
5	20	3·82	0·082	6,457	3·89	0·120	7,025
		Steam plant (coal at 8s.).			Battery (coal at 8s.).		
1	4	3·89	0·150	5,992	1·54	0·220	2,752
2	8	3·89	0·150	6,340	2·21	0·220	4,243
5	20	3·89	0·150	7,384	3·89	0·220	8,250

It will be seen that on a 1-hour basis and with coal at 8s. per ton the total annual cost with the batteries is only £2,752 as against £5,576 when delivering the power direct to the bus-bars without cells by means of rotary converters. The cost of the energy wasted in the cells and boosters is in the case of the gas plant only 0·04d. per unit, and in the case of the steam plant with coal at 8s. per ton it is only 0·07d. per unit delivered to bus-bars. With coal at 12s. per ton, and with steam plant, the cost of the energy wasted in the cells and boosters is 0·11d. per unit. The higher the fixed charges and the lower the running cost of the generating plant, the better does the battery show up as a substitute for it. It would seem, therefore, that where the average duration of the load supplied by the accumulators is from one to two hours, and coal is moderately cheap, there is undoubtedly a good case for accumulators. Even, however, where coal is dear, there is generally a sufficient saving in standby losses on boilers and engines, which can be entirely shut down, to make the value of the coal so saved fully equal to that lost in the inefficiency of the battery. This is exemplified in the case of Manchester, where the coal consumed per unit delivered to bus-bars, at Dickinson Street, for a particular period of the year, is stated to have been reduced by 25 per cent., this taking account of the losses in the accumulators and boosters.

The introduction of the split-pole rotary converter, as developed in the United States, has given an incentive to the use of batteries on A.C. systems as equalisers of the load. No doubt the employment of accumulators on A.C. systems would be greatly extended if some less expensive and more flexible means could be introduced for charging and discharging them than that employing rotary converters, though this is perfectly practicable. For instance, if an ideal rectifier were available, a considerable stimulus would be given to the introduction of batteries on the premises of large consumers who were agreeable to take a restricted-hour supply at cheap rates. The author has devised a rectifier which he anticipates will permit of momentary overloads being passed through it many times larger (proportionately) than those which would cause the commutator of a rotary converter to flash over, and which should also be capable of dealing with large currents and of commutating direct currents into alternating currents. The question of the employment of batteries on alternating-current systems is increasing in importance, because not only can the load factor be improved thereby, but also the power factor.

The author thinks, however, that if it can be shown that, even in pure alternating-current distribution, the employment of battery sub-stations will not only reduce the amount of generating plant (including boilers, &c.) in the main station, as well as the aggregate section of the E.H.T. feeders emerging therefrom, by some 20 to 30 per cent., but will also reduce the amount of wattless current sent out from the main station to an insignificant amount, and thereby liberate probably another 10 to 20 per cent., or even more, of the whole of the electrical part of the plant (including feeders), engineers will think twice before they dismiss the double advantage on the sole objection that to introduce sub-stations with rotating machinery requiring skilled attention, in place of feeders, would be a retrograde step.

In the author's plan for improving the power factor in a pure (or mixed) alternating-current system, a rotary converter or motor-generator A and its battery C are used for taking up the peaks of the load in a manner well understood. A second rotary converter, motor-converter, or motor-generator B is a synchronous machine, and is over-excited in such a manner that it runs as motor, fed from the alternating-current line, and draws a leading wattless current therefrom sufficient in value to compensate for the lagging wattless currents taken by the consumer's motors.

The special feature of the author's proposal is that the rotary converter B is enabled to find a useful load for itself by charging the battery D, and thus a given kilovolt-ampere motor load can be dealt with with a much smaller expenditure in synchronous machines than would otherwise be the case.

When the evening peak load comes on, the charge in the battery D is available in assisting the rotary A to deal with the load; and the motor-generator B may either be used to perform phase-changing by itself, or, if not needed for that, is available to assist the motor-generator A in dealing with the peak.

The fact that batteries can now be constructed, and are in use, which will give outputs up to 40,000 amperes, shows that the lead-plate type of accumulator has now passed the experimental stage from the point of view of reliability, and central station engineers need no longer be afraid that if they put in a battery they may have to scrap it at the end of two or three years. Battery makers of repute are now to be found who will undertake the maintenance of cells for periods of 10 to 20 years. As things stand, it would seem to be quite safe to install large batteries of the lead-plate type, and even if in a few years' time the long-expected ideal battery should make its appearance, no particular loss would be involved, provided a life of some seven years had already been obtained out of the lead-plate battery.

The author wishes to point out the great value that a battery of the New York "Exide" type would have when used as a supplement to the steady discharge battery, the latter being employed for dealing with the regular peak, and the former purely for exceptional demands which only occur very rarely, such as breakdowns or fogs.

It is found that if a battery be constructed to stand a comparatively few discharges during its lifetime—say, perhaps, 10 per cent. of what would otherwise be expected—such a battery can be made for, perhaps, half the cost, and will take up, perhaps, only two-thirds of the space of the ordinary battery.

DISCUSSION.

The discussion was opened by MR. B. M. JENKIN, who said the idea of splitting the booster into three parts was very interesting. Referring to the diagrams shown by the author, the chief value of a battery was on the discharge, and it would seem to be a mistake to make it do anything but supply the load during that time. If a booster were used for discharging it took valuable current at peak load; for charging, the booster took current at a time which did not much matter. There did not appear to be any need for the complicated switchgear proposed with the author's triple-booster arrangement, but he thought that the changing from series to parallel, and back again, in emergency would rather tax the operator. He suggested that an alternative arrangement, in which a booster would be in circuit with the battery normally, but would be cut out—the battery being coupled direct to the line—in emergency discharging, would be preferable.

MR. C. E. C. SHAWFIELD said he could not agree with the proposal to use a battery only as a stand-by, and he could not imagine conditions in this country where a five minutes' discharge would be required, or, at any rate, where it would avert a shut down. A one-hour rate appeared to be the least that should be considered. It was generally considered that the booster method was the most economical one for battery charging and discharging—particularly the latter; but in Berlin he found that such apparatus was only used in the charging. The extent to which batteries were used in Berlin was astonishing; he believed that an emergency supply to the whole of the city for two hours was available, and that the batteries were used on account of the economies made possible in the boiler house and as an insurance against the possible heavy penalties in connection with the railway supply and that to the municipality. In this country, however, the battery could only justify its existence in so far as it actually tended to reduce the cost of generation, but it should be limited to a two or three-hour rate of discharge.

MR. S. L. PEARCE pointed out that taken over the whole year the coal bill at Manchester had been reduced by 13 per cent. (not 25 per cent. as mentioned by the author) since the introduction of the battery (of which a very full description by Mr. Pearce appeared in our issue of July 22nd, 1910). The battery was originally charged from the traction bus-bars and discharged on the lighting peak load, but it was arranged for use entirely on the lighting side, and the most economical results were found by so using it. The actual reduction in coal used per unit was from 3·3 lb. to 2·89 lb. on an output of 30 million units. Altogether in the first year the saving amounted to £3,431, but if capital charges were considered, allowing £13 per KW. for steam plant and £8 per KW. for battery plant and taking 8½ per cent. loan charges, &c. on the £5 per KW. saved by installing the battery, another £2,000 saving was obtained, making, approximately, £5,000 in all, a figure which did not differ much from a rough estimate of the saving obtained by substituting a 5,000-KW. battery for steam plant, given by the author.* The combined overall efficiency of the battery and booster plant over a year was 71 per cent.; the units lost in the battery and boosters were 700,000 on the output of 30 millions, and these were covered four times over by the coal saving. The Manchester battery had actually been discharged at rates of 8,400 amperes in one hour, 13,000 amperes in half an hour, and 17,000 amperes in five minutes, and, in view of his experience with switches to carry the latter amount, he wondered how the Americans managed with their 40,000-ampere emergency-discharge switches, to which the author had referred. If a battery was large enough to supplant peak steam plant, it should be quite good enough for emergency purposes. At Manchester there were three boosters in use, and these were operated in series or parallel, accord-

* This will be found in our "Notes" columns.—EDS. E.R.

ing to the conditions obtaining at the time; the switching arrangements gave no difficulty, without using the complicated switches proposed by the author. He (the speaker) was inclined to think the Manchester booster arrangements preferable to Mr. Taylor's triple booster. In conclusion, he drew attention to the very short period—only seven years—allowed by the L.G.B. for loan repayments on battery plants; the makers would guarantee a battery for 15 years.

MR. A. H. SEABROOK said he was faced with the problem of providing some 3,000 KW. extra plant capacity to supply an area some distance from the generating station, and had considered the battery question very closely. He found that steam plant would cost £57,000, and a suitable battery plant about £26,000. At present there were some small batteries in use at Marylebone, and he had found the overall efficiency of one battery to be 75 per cent., but including the booster plant the efficiency was only 54 per cent, which was very much less than the figure given by Mr. Pearce. He thought there was a good deal in the use of regulating cells, as on the Continent; end cells were more reliable than boosters and required less looking after.

MR. LEONARD ANDREWS thought the author's standing charges on the steam station were rather high. The author appeared to reduce the cost of labour in the same ratio as the maximum demand, which was not correct. The fixed charge for gas plant was also very high, although, if reduced, it would still end favourably to the battery scheme.

MR. A. M. TAYLOR, in replying, said booster losses were usually very serious, and he was not surprised at Mr. Seabrook's battery efficiencies. If one could use very small boosters the losses would be proportionately smaller; but the battery losses were the great item. He had figured on £13 per KW. in the paper, and the annual cost per KW. of £3·89 seemed about right. As regards the booster arrangement, if smaller machines could be used by his method, then for the same money as was spent at present spare plant could be obtained. Mr. Pearce had three boosters, which would take the emergency discharge, but he had no spare plant. In scheme B (fig. 7) the booster was much more efficiently loaded and worked than in scheme A (fig. 6).

German v. British Foreign Trade Methods.—A correspondent who has followed our recent articles on export electrical trade sends us a copy of the *Saturday Evening Post* (Philadelphia), containing a contribution by James H. Collins on "The German Export Trade." The writer endeavours to show how the German traders have studied British methods of doing business and copied them in building up their export trade, even adopting some of the shortcomings of the British system, for "they still adhere to the old-fashioned plan of selling only what customers want, and perhaps want badly . . . . Providing the customer with novelties that he really needs, but doesn't know he needs, is a way of doing business not yet largely developed by German exporters." The writer proceeds:—

"Putting a branch right into the customer's territory and maintaining a force of salesmen to sell him something like an adding machine or a cash register is still rather exceptional in both German and British exporting. We have built up a large trade in Canada on this plan of doing business, and the American houses that have gained a foothold in England and Europe follow it too, as a rule. In Canada, for instance, the British manufacturer finds himself at a disadvantage in selling against us, even with a tariff preference, because he is too far away. He makes good stuff, but knows little about his ultimate customers. A London exporter takes his product, along with that of hundreds of other export manufacturers, and parcels it out all over the world. Presently a German manufacturer succeeds in producing something cheaper, which is sold in Canada on the same plan, and the English trade is lost, because it is done almost wholly as a matter of prices and discounts. Then an American manufacturer enters Canada with the latest improved article, forms direct connections with merchants through his own salesmen, advertises to the consumer and increases the demand tenfold, while getting better prices. The English or German manufacturers have nobody to introduce their novelties with the same interest; and they dare not go to Canada and deal with customers direct, for if they do this their exporters will stop carrying their goods to Australia, South America and dozens of other countries. The German's best achievements in export trade have been secured through getting closer to his customers. He sends his sons to South Africa or South America as soon as they are out of school, and they not only learn the language in the countries where he does export business, and get close to customers on a sort of jobbing basis, but they even marry into the country and bring back a South American wife and some pesos to put into the business. This closer contact with the world's markets, and willingness to get the foreigner anything he wants so long as he is really certain that he wants it, has given the German his chief advantages over the British exporter. John Bull is inclined to deal somewhat at a distance. He makes jolly good stuff, but it isn't always attractive. He likes to sell the foreigner what is good for him, even if the latter doesn't see it. John Bull will make some concessions to get foreign trade, but he won't marry into it."

Well, with us there are limits—Salt Lake City has ways of its own!

This criticism of our knowing little about our ultimate customers is one that has come for a long time past from almost every market in which we have trade connections. If we would only remedy this, as has been so often advised, we might do a great deal better.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIA.—The Australian Commonwealth Customs Department has recently made an important alteration in the regulations which define the meaning of "British origin" for purposes of entry under the Preferential Tariff. Formerly goods were considered to be of British origin if not less than 25 per cent of their value were produced by British labour, independently of whether or not they had a distinct British appearance. Now, however, it has been decided that they shall be required to be finished in the United Kingdom and to have a distinctly British character. Consequently in place of the certificate of origin formerly in use to secure entry under the Preferential Tariff, the following certificate, the terms of which should be carefully noted, has now been decided upon. This form will be required in all invoices for British goods to which it can apply on and after September 1st, 1911. The certificate must be written, printed or stamped on the back of invoices:—

I,.....the...(manufacturer or supplier)...of the articles included in this invoice, amounting to £.....and dated..... of goods supplied to.....do hereby declare that I have the means of knowing and I hereby certify as follows:—

(1) That the said invoice is in all respects true and correct;

(2) That every article mentioned in the said invoice has been either wholly or partially produced or manufactured in the United Kingdom;

(3) As regards those articles only partially produced or manufactured in the United Kingdom:—

(*a*) That the final process or processes of manufacture have been performed in the United Kingdom;

(*b*) That the expenditure in material of British production and/or British labour (calculated subject to the qualification hereunder) in each and every article is not less than one-fourth of the *factory or works cost* of such article in its finished state.

(4) That in the calculation of such proportion of British production or British labour none of the following items have been included or considered:—

Manufacturer's profit or the profit or remuneration of any trader, agent, broker, or other person dealing in the article in its manufactured finished condition;

Costs incurred in the mere packing of foreign-made goods in, *e.g.*, cartons or other containers;

Cost of outside packages or any cost of packing the goods thereinto;

Any cost of conveying, insuring, or shipping the goods subsequent to their manufacture.

(5) (1) That with regard to goods put up in bottles or jars (if there be any such mentioned in the invoice) the foregoing paragraphs apply to the *contents* of the bottles or jars; and

(2) With regard to bottles or jars being containers of goods mentioned in the invoice—

That such bottles or jars are of British manufacture, and if purchased from Bottle Exchanges have distinctive marks or features which enable me to certify to their British origin.

(If par. 5 (2) cannot be certified to, the Certifier should strike it out.)

Witness..... (Signature).....

Dated at.....this.....day of.....19.....

If the certificate is to be signed by any other than the manufacturer or supplier the following will be substituted for the introductory paragraph above:—

I, (full name) hereby certify that I am ("partner," "manager," "chief clerk," or "principal official") of (name and address of manufacturer or supplier) the ("manufacturer" or "supplier") of the articles included in this invoice amounting to..... dated.....of goods supplied to.....and do hereby declare that I am duly authorised to make and sign this certificate on behalf of the said ("manufacturer" or "supplier"), that I have the means of knowing, and do hereby certify as follows:—

British Trade in Chile.—The British Consul at Antofagasta, in a recent report, states that Chile, and the northern portion of it in particular, is a country where the extension of trade in manufactured goods is dependent upon the employment of travelling agents, and it cannot be too strongly impressed upon British merchants and manufacturers that unless they adopt this method they must not hope to secure a fair share of the trade. The travellers must speak Spanish and be well equipped with samples and fully authorised to arrrange financial details with their customers. They should be the best class of men obtainable, and besides being liberally remunerated, they should be allowed considerable discretion in incurring expenses in pushing their goods. This will no doubt be considered irresponsible advice by most British exporters, but it is not so. It is the method adopted by foreign competitors, and any who wish to share the trade will have to do likewise or meet with disappointment. It is perfectly useless to shower printed catalogues upon the Consulates and then expect business to result. Consuls can neither recommend firms at home nor dealers abroad, and their withholding recommendations is not likely to inspire confidence in either. Foreign travellers are constantly seen entertaining possible customers, and the simple reason is that if a footing is desired it has to be paid for in the first inst nce.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,406. "Telegraphic transmission of pictures and the like." F. Wyndham. April 18th.

9,422. "Method of and means for regulating and maintaining pressure and power on an electric supply circuit." A. E. Salisbury and T. Mills. April 18th.

9,475. "Brake electromagnet for tramway and like vehicles." C. Shears. April 18th.

9,492. "Telephone switchboards." W. Aitken and British Insulated and Helsby Cables, Ltd. (Addition to No. 1,050, 1910.) April 19th.

9,493. "Method of and means for changing the frequency of an alternating-current circuit." A. M. Taylor. April 19th.

9,514. "Method of obtaining continuous currents from alternating-current circuits." A. M. Taylor. (Addition to No. 20,867, 1909.) April 19th.

9,523. "Twin or multicore electric cables." C. J. Beaver and E. A. Claremont. April 19th. (Complete.)

9,528. "Generators of electrical energy." A. Sandrini and C. Sanguineti. April 19th. (Complete.)

9,556. "Tachytelegraph and teletype machines." E. Belin. April 19th. (Complete.)

9,573. "Electromagnetic levitating and transmitting apparatus." E. Bachelet. April 19th. (Complete.)

9,575. "Electromagnetic instruments." W. K. Menns. April 19th. (Complete.)

9,577. "Telephone systems." S. G. S. Dicker. (Automatic Electric Co., United States.) April 19th.

9,595. "Means of regulation for electric motors with series field windings." W. A. Stevens. April 20th.

9,598. "Electrically-driven hydraulic lifts." E. M. Tudor Boddam. April 20th.

9,606. "Controllers." Siemens Bros. Dynamo Works, Ltd., and E. Schupp. April 20th. (Complete)

9,633. "Electrodes for electric furnaces." O. Imray. (Shawinigan Carbide Co., Ltd., Canada.) April 20th. (Complete.)

9,649. "Carbon electrode for galvanic batteries in which the electrolytic fluid or the depolarising gas or the mixture thereof is conveyed through the pores of the negative electrode." S. Benko. April 20th. (Complete.)

9,652. "Carbon electrode for electric furnaces." L. E. Bussey. (Planiawerke Akt. Ges. für Kohlenfabrikation Ratibor, Germany.) April 20th. (Complete.)

9,686. "Electrical switches." G. H. White. April 21st.

9,717. "Electrically-driven pumps." J. C. Merryweather. April 21st.

9,719. "Electric incandescent lamp." O. Schaller. (Convention date, April 21st, 1910, Germany.) April 21st. (Complete.)

9,725. "Electro-capillary contrivances." Axel Orling and Orling's Telegraph Instruments Syndicate, Ltd. April 21st. (Complete.)

9,730. "Electric alarm clocks." G. E. Joly. April 21st.

9,739. "Connections for electrical uses." W. E. Lake. (Soc. Anon. le Carbone, France.) April 21st.

9,745. "Device for indicating an earth or ground connection of an electric line." G. G. Giles. (Convention date, April 21st, 1910, Switzerland.) April 21st. (Complete.)

9,796. "Apparatus for paying out hygienic interceptors for telephones." L. B. Claremont. April 22nd.

9,799. "Sparking plugs and the like adapted for internal combustion engines." H. F. Smith. April 22nd.

9,806. "Reflectors for incandescent electric lamps," E. Booth and N. R. Booth. April 22nd.

9,815. "Electric incandescent lamp." O. Schaller. (Convention date, April 22nd, 1910, Germany.) April 22nd. (Complete.)

9,816. "Electric incandescent lamp with a liquid incandescing body." O. Schaller. (Convention date, April 22nd, 1910, Germany.) April 22nd. (Complete.)

9,819. "Electrical measuring instruments." G. North. April 22nd.

9,840. Apparatus for producing electric ignition in internal combustion engines." R. Bosch (Firm of). (Convention date, March 27th, 1911, Germany.) April 22nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electrically Controlled Pressure-Regulating Devices. Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co.) 7,428. March 24th.

Process for Improving the Mechanical and Electrical Properties of Copper. Electrochemische Werke Ges. 7,657. March 29th. (March 30th, 1909.)

Automatic Telephone Systems. E. Neuhold. 7,659. April 20th. (April 20th, 1909.)

Cooling Devices for Telephone Transmitters. C. E. Egner and J. G. Holmstrom. 8,019. (June 29th, 1909. Addition to No. 7,656 of 1910.)

Apparatus for Actuating the Conduit Covers of Electric Tramways on the Slot-Conduit System. D. Samaia. 8,862. April 12th.

Zinc Carbon-Bag Electric Elements. W. Weber and A. Schmidt. 10,561. April 29th.

Exhaustion of Incandescent Electric Lamps. F. Harrison. 10,870. May 3rd

Method of Manufacturing Electric Condensers. W. Burstyn. 11,787. May 12th. (May 12th, 1909.)

Electric Time-Signalling Apparatus. W. Rausch. 12,316. May 19th.

Electric Resistances. Clarke, Chapman & Co. and R. C. Harris. 12,428. May 21st.

Machines for Making Incandescent Electric Lamps. W. L. Pakenham and "Z" Electric Lamp Manufacturing Co. 12,754. May 25th.

Art of Synchronising Alternating-Current Generators. H. W. Lake. (Weston Electrical Instrument Co.) 13,336. June 1st.

Electrical Conductors. Siemens Bros. & Co. and W. Dieselhorst. 13,672. June 6th.

Electric Furnaces. J. Thomson. 15,161. June 23rd. (September 1st, 1909.)

Revoluble or Oscillatory Electric Furnaces. J. Thomson. 15,165. June 23rd. (September 1st, 1909.)

Electric Accumulator Boxes. G. E. B. Pritchett. 15,425. June 27th.

BOOK NOTICES.

Electrical Engineering Abstracts. Vol. I, 1910. London: The International Institute of Technical Bibliography. Price 24s. to non-members.—We have received a complete set of the numbers comprised in the first volume of this publication, in the section of Electrical Engineering; there are five other sections, covering respectively mechanical and civil engineering, mining and metallurgy, applied chemistry, and a supplement. Members of the International Institute of Technical Bibliography receive one section free, and can obtain the others at half-price.

The purpose of this fortnightly publication is "to list and arrange systematically all books and articles dealing with Engineering and Technical Science." The abstracts are extremely brief, being indeed of the nature of concise descriptions of the character and scope of the articles rather than abstracts, and in every case they are couched in the language of the original publication.

The Institute itself has branches in various countries, and is said to deal with more than 100,000 books and articles annually, the journal forming, it is claimed, the most complete technical index yet published.

While we are disposed to think that the field was pretty well covered by the numerous publications of a similar nature which were previously, and still are, in existence, that is, no doubt, a matter for the authors. So far as we can judge from an examina- of the contents of the journal, they are truly cosmopolitan, and cover an enormous area of electrical activity; as a work of reference its value will increase with its years.

The Elements of Telephony. By Arthur Crotch. London: E. & F. N. Spon. Price 1s. 6d. net.—In this little book the author, who has already published several useful works on telegraphy and telephony, expounds to the unlearned the means and methods adopted in present-day telephone practice. The reader is supposed to have some slight acquaintance with the subject, but sufficient introductory matter is given to enable the intelligent telephone subscriber, with a rudimentary knowledge of electrical phenomena, to read the book with edification and profit. The treatment is concise and clear, and covers the apparatus and connections required in the working both of a small private exchange, and of central exchanges of the common-battery type, the latter occupying about half the book. The operations involved in the course of "getting through" are explained in order, and the ramifications of the connections in that most marvellously developed and highly organised mass of complexity, a C.B. exchange, are made clear with the aid of excellent diagrams and illustrations. The author is to be congratulated on having produced an admirable and useful little work.

The Gyroscope. By V. E. Johnson, M.A. London: E. & F. N. Spon. Price 1s. 6d. net.—This is an experimental study of the gyrostatic principle "from spinning-top to monorail," founded on a series of articles published in the *Model Engineer*. The author is an enthusiast, and enumerates a variety of applications for the gyroscope, of which only one or two have been utilised in practice; but it would be unwise to underestimate the possible importance of this fascinating device in the future. His little book, therefore, is very acceptable, providing a means of familiarising the young engineer with the peculiar properties of the gyroscope, and giving him abundant food for thought. The bulk of the contents consists of instructions for carrying out experiments with gyroscopes of various types, from the simplest toy to elaborate devices with controlling planes of the Brennan type, applied to a model monorail train. Those who have the leisure to follow the author's steps will find this little book an interesting guide.

West Ham Electrical Bulletin. The *Bulletin* of the West Ham Corporation for April is an excellent example of publicity work. The leading feature is an account of the Thames Iron Works and Shipbuilding Yard, with many illustrations; the West Ham Hospital, and another works in West Ham, are also described, and all these, including the Thames Iron Works Co., derive the whole of their electricity supply from the Corporation Electricity Department. We congratulate the staff on a very good issue.

"*Journal* of the Western Society of Engineers." Vol. XVI, No. 3. March, 1911. Chicago: The Society. Price 50 cents.

"Engineering Estimates, Costs and Accounts." By A General Manager. 1911. London: Crosby Lockwood & Son. Price 7s. 6d. net.

"Note on the Electrical Waves occurring in Nature." By W. H. Eccles, D.Sc., and H. M. Airey, M.Sc. Excerpt from the *Proceedings* of the Royal Society. From the authors.

"The American Institute of Architects' Quarterly Bulletin." Vol. XI, No. 4. January, 1911. Washington: The Octagon.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVII, Part 2. March, 1911. London: Andrew Reid & Co., Ltd.

"A Handbook of Wireless Telegraphy." By J. Erskine-Murray. 1911. London: Crosby Lockwood & Son. Price 10s. 6d. net.

"Public Ownership of Telephones on the Continent of Europe." By A. N. Holcombe. 1911. London: Constable & Co. Price 8s. 6d. net.

"Wiring Rules" of the Institution of Electrical Engineers. New Edition. London: E. & F. N. Spon. Price 6d.

The Elektrotechnischer Verein, of Vienna, is about to issue a volume entitled "Statistik der Elektrizitätswerke in Oesterreich," containing particulars of 800 electricity works in Austria and Bosnia-Herzegovina. Subscribers, before publication, may obtain it for 2·80 kronen (2s. 4d.); after publication the price will be 3·80 kronen.